NUTRITIONAL PROFILE AND ENDURANCE CAPACITY OF ADOLESCENT GIRLS

By

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THESIS

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DECLARATION

I hereby declare that the thesis entitled **"Nutritional profile and endurance capacity of adolescent girls"** is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, fellowship or other similar title, of any other University or Society.

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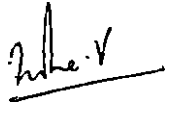

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Seeja Thomachan Panjikkaran

Dedicated

To my loving parents

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Introduction

INTRODUCTION

Adolescence is a vulnerable period in human life cycle. It is a period of rapid growth and development and is an important milestone in the life of human being from birth to adulthood. The rapid physical, sexual and mental changes occurring during adolescence are influenced by many factors like genetics and environment including nutritional status and bouts of illness. According to Nair *et al.* (2000) adolescent period is the second and last chance to make up the nutritional deficits, the first one being the infancy.

During the period of adolescent growth more than a third of adult weight and nearly a fourth of adult height is acquired. The gain in skeletal weight is most rapid during the adolescent growth spurt. Blood volume and muscle mass increase and this inturn is found to increase the need for haemoglobin formation. Iron deficiency anaemia is undoubtedly one of the most serious public health problems related to nutrition during adolescence. Incidence of anaemia among adolescent is high in teenage girls due to rapid growth, onset of menstruation and under nutrition. Iron deficiency anaemia impairs physical efficiency and productivity. Work capacity and work output depends on the quantity and quality of their calorie and nutrient intake and the resulting nutritional status.

Adolescent girls need more nutrition for the rapid pubertal and post pubertal physical growth preparing them for future motherhood. Girls are in a most disadvantageous position and remain as unrecognized segment of the population when compared to adolescent boys (Devadas, 2000). Prevalence of malnutrition

among adolescent girls is a matter of concern from the point of view of the quality of future generation. Their attainments and competence will be the major determinants of the health and nutrition of our next generation. But this group of population has been neglected in most of our developmental and education programmes. Only a few reports are available from Kerala regarding the health and nutritional status of adolescent girls. Hence this study was undertaken to find out the nutritional status of school going adolescent girls and to assess the effect of nutritional status on their endurance capacity.

Review of Literature

2. REVIEW OF LITERATURE

2.1 Importance of adolescence

Adolescence is derived from the Latin verb 'adolscere' meaning 'to grow into maturity'. According to Runyan (1976) adolescence in contrast to puberty is not a single age or stage but a range of years (13-18 years) during which an individual develops from a child to an adult. Hurlock (1978) designates the years from 10-12 as pre-adolescence, 13-16 years as early adolescence and 17-21 as late adolescence. Early adolescence is from the beginning of the pubescent growth spurt until a year after puberty when the new biological functions are fairly well stabilized (Devadas and Jaya, 1984).

According to Berk (1989) puberty is caused by an increase in the activity of growth hormone and gonadotrophic hormone. Steinberg (1989) stated that puberty is used as a collective term to refer to all physical changes that occur in the growing girl or boy as the individual passes from childhood into adult hood.

Adolescence is the most crucial period in one's life. It begins with the onset of puberty and ends with the assumption of adult responsibilities. As stated by Mussein (1990) adolescence begins in biology and ends in culture.

The term adolescence includes mental, emotional and social maturity as well as physical maturity (Drawtzky, 1990). Williams (1993) stated that adolescence is an ambivalent period full of stresses and strains. Adolescence is the period of life beginning with the appearance of secondary sex characteristics and

ending with the cessation of somatic growth (Sendrovirtz, 1995). According to Mahan and Sturps (1996) adolescence is one of the most challenging period in human development. Because of the extent of physical and psychological changes taking place, a number of important issues arise that influence the nutritional well being of the teenagers.

Adolescence, the second decade of life, is a crucial and dynamic time in lives of all young people. They go through a difficult phase of physical, emotional and psychological stress. Physically adolescents begin to reach their adult size, their bodies become sexually defined and reproductive capability is established (Singh, 1998). According to Bagchi (1999) the period of adolescence is marked by profound physiological, anatomical, endocrinal and emotional changes. Adolescence is a period of rapid growth and maturation in human development after infancy National Nutrition Monitoring Burea (NNMB, 2000). Adolescence provides a 'second opportunity to undo, however partial the deleterious effects of early childhood under nutrition (Devadas, 2000).

2.2 Importance of adolescent girls

Female adolescence is the phase of growth and development bridging childhood and womanhood; a physical transition necessitating unique social and psychological adjustment (Hoey *et al.*, 1986).

The girl child is considered to be a lesser child and the discrimination against her is rampant in all strata of society irrespective of class, caste and economic conditions. The attainments and competence of these girls will be the

major determinants of health and nutrition of children in the next generation (Gopalan and Kour, 1989). Adolescent girls is precisely the group of future home makers, that is destined to play the vital and determining role with respect to physical and mental caliber of the coming generation (NFI, 1989). The nutritional status of the adolescent girl, "the future mother" contributes significantly to the nutritional status of the community National Nutrition Monitoring Burea (NNMB, 2000).

Shivpuri (1990) has the opinion that adolescent girls in India are more neglected than adolescent boys. According to Akkamahadevi *et al.* (1998) adolescent girls are a neglected sector of population in India and are poorly fed members of the family.

Certain indicators of sexual maturity mark puberty; in girls time of first menustration, menarche is the general criterion for the onset of puberty (Devadas and Jaya, 1984). Menarche is an important event, it land marks the sequential changes in the developmental process during adolescence (Parveen and Beegum, 2001).

According to Census of India (1991) adolescent girls constitute 10.0 per cent of the females of the total population in India.

2.3 Prevalence of nutritional disorders among adolescent girls

Adolescence is a critical period in the development of deficiency diseases (Coy and Kenny, 1984). Nutritional requirements especially at the age of 13-15 years increase owing to the spurt in growth that occurs in puberty (Sood

and Kochar, 1993). Increased nutrient needs are easier to achieve by boys than by girls who frequently undergo social and peer pressure (Williams, 1993). Rousham (1997) opined that female children of poor socio-economic status appears to have experienced the greatest disadvantage in terms of nutritional status. Girls are in a most disadvantageous position and remain as unrecognized segment of the population when compared to boys (Devadas, 2000).

Nelson *et al.* (1993) reported that occurrence of vitamin A deficiency, anaemia and vitamin B complex deficiency are common among adolescents. According to Vijayalakshmi and Vijayalakshmi (1994) the signs of nutritional deficiencies prevalent among adolescents included angular stomatitis, bleeding gums, coloured tongue and dental carries. Chaturvedi *et al.* (1996) reported signs of vitamin B complex deficiencies (43.6%) among adolescents. National Nutrition Monitoring Bureau (NNMB, 1996) reported prevalence of bitot's spots and angular stomatitis among adolescents of both sexes. According to a study conducted by Ahmed *et al.* (1997) in 388 adolescent girls of Bangladesh 56 per cent had serum vitamin A concentration below adequate with 14 per cent suffering from vitamin A deficiency.

Anaemia due to iron deficiency is a major nutritional problem in the world affecting an estimated 2170 million people of which 90 per cent may be found in the developing countries World Health Organization (WHO, 1992). According to Demeyer and Adrels (1994) 47 per cent of women of reproductive age in developing countries are anaemic. According to Vir (1999) iron deficiency

anaemia is most prevalent and severe in pregnant women, young children and adolescent girls.

Bindra and Gibson (1986) conducted a study in Punjab and found that iron deficiency is more common in females (33%) than in males (5%). According to Gopalan (1992) a great majority (nearly 2/3) of young adolescent girls in the countries of Indian subcontinent are anaemic. A study conducted by Chandrasekhar *et al.* (1993) in rural and urban areas of Coimbatore indicated the prevalence of anaemia among adolescents as 88.3 per cent in rural and 86.6 per cent in urban areas. According to Kanani (1995) 65 to 75 per cent of the underprivileged adolescent girls of 10 to 18 years in India are anaemic. Vizcaino *et al.* (1995) reported a high incidence of iron and folate deficiency among adolescents, especially in girls. A survey of 12-18 year old girls in rural India found an anaemia prevalence rate of 82.9 per cent among girls in schools and 92.7 per cent among girls not attending schools Survival for Women and Children Foundation (SWACF, 1997). A recent report on prevalence of anaemia amongst adolescent girls indicated that incidence of anaemia increases from 10 years onwards and continues to remain high till 18 years of age. The incidence of anaemia in this group is reported to be above 50 per cent in a multicentric study in India (Agarwal, 1998; Mehta, 1998; Seshadri, 1998). Benefits of effective iron deficiency anaemia control programme among adolescent girls as stated by Stoltzfus and Dreyfuss (1998) included improved cognitive development and better iron stores for later pregnancy.

Haemoglobin studies of large number of school girls in India have shown that more than 50 per cent of them have haemoglobin levels less than 10.8 g/100 ml (Sumati and Rajagopal, 1990). Data on the haemoglobin status of adolescent girls in urban and rural areas indicated that 7 per cent of the girls in urban and 16 per cent of girls in rural areas had haemoglobin levels of less than 10 g/100 ml Nutrition Foundation of India (NFI, 1997).

Raman (1991) stated that the onset of menarche in the girls had a significant impact on the iron nutritional status. Vasanthi *et al.* (1994) reported that about 25-50 per cent girls became anaemic by the time they reach menarche. Nair (1999) observed that menustral bleeding causes an additional loss of 0.4 to 0.5 mg iron daily. Iron stores are depleted during adolescence due to increased needs of iron for rapid growth and loss of iron with the onset of menarche. From the Indian cereal based diets which contain less than 10 mg iron/day, the dietary bioavailable iron remains very low resulting in over 50% of iron deficiency anaemia in girls (Vir, 1999).

The assessment of nutritional status of adolescents in New Delhi belonging to different socio economic background by Kapoor and Aneja (1992) reported goitre-grade, I in a large proportion of adolescents. According to NNMB (1996) report, the total prevalence of goitre grade I was found to be 6.8 per cent in Kerala and 2 per cent of boys and girls had grade II goitre. The overall prevalence was marginally higher in girls (3.9%) as compared to boys (2.8%).

According to Tamilarasi and Sasirekha (1990) adolescents with special reference to girls are concerned about their weight and obesity was more prevalent among adolescent girls. Flynn (1997) observed that fear of fatness is pervasive among adolescent girls and is associated with many unhealthy behaviours which carry serious long-term health risks. Du *et al.* (1998) conducted a study on Chinese adolescent girls and reported the prevalence of over weight and obesity as 7.7 per cent and 12.4 per cent while underweight was very high as 32 per cent. Inadequate nutrient intakes contributed to the problem of underweight.

2.4 Food consumption pattern

Rosa and Favaro (1986) reported that diets of low-income population are cereal based, and most of the nutrients are met by cereals. Sarupriya and Mathew (1988) conducted a diet survey among adolescents of a tribal village in Rajasthan and revealed that the intake of cereals was higher than that of recommended but that of pulses and roots and tubers was low and no leafy vegetables, fruits, nuts or oilseeds were consumed. According to Sarojini and Vijayalakshmi (1989) consumption of foods by adolescent girls with moderate activity and heavy activity was very different from each other. They found that intake of milk, milk products and fruits was low in the case of girls with heavy activity and intake of green leafy vegetables was low in girls with moderate activity.

Rajesh (1991) and Pandey (1995) observed that teenagers often eliminate leafy vegetables and thus lack nutrients, which are important for their

growth. Mathew and Bhatnagar (1992) found that quantity and quality of foods consumed by adolescents were far below the recommended dietary allowances as suggested by ICMR for an average Indian adolescent girl. Paul (1993) reported that intake of cereals and fish was higher than recommended levels in adolescents of Kerala. The intake of pulses, other vegetables, fruits and milk was less than RDA and consumption of green leafy vegetables was far below the recommended levels.

Zeszyty *et al.* (1994) conducted a study among the adolescents in Poland and found the daily intake of cereal products, meat, poultry, fish, cured meat products, butter and sugar was above the recommended levels, whereas that of milk and milk products, eggs, fats, vegetables and fruits high in ascorbic acid, vegetables, high in carotenoids and legumes was below the recommended level. Samuelson *et al.* (1996a) from a nutritional survey on adolescents in Sweden found that boys and girls consumed cereals, butter or margarine and something from the group meat/fish/eggs every day. Milk, milk products, sweets and snacks were consumed more than once per day. Lalmas *et al.* (1996) conducted a study on food intake and dietary habits of adolescents in South East Spain and found that they had very low intake of vegetables, milk products and fruits. Ahmed *et al.* (1997) collected food frequency data on vitamin A rich foods among female adolescents in Dhaka city and revealed that a large percentage of the subjects did not eat eggs (41%), milk (64%), liver (85%) and sweet pumpkin (85%). However, about 40 per cent of girls did eat dark green vegetables.

A study conducted by Akkamahadevi *et al.* (1998) found out that the intake of green leafy vegetables, other vegetables, fruits, iron rich foods, cereals, pulses, sugar, jaggery and milk and milk products was low in adolescent girls.

According to Paul (2001) in Thrissur district of Kerala the intake of cereals was found to be low in boys when compared to RDA (82%) whereas in girls the cereal intake was found to be high (106.8%). Consumption of other vegetables and green leafy vegetables was found to be significantly lower than the recommended values in girls.

Marin *et al.* (1988) reported from their survey that energy intake of adolescent boys did not differ significantly from the ideal values whereas in adolescent girls energy supply was found to be deficient. As observed by Reggiani *et al.* (1989) the intake of energy by adolescents was lower than recommended for their age. Saini and Verma (1989) observed that the daily mean intake of energy in adolescent girls from high socio-economic group was significantly more, compared to those from low socio-economic group.

Witschi *et al.* (1990) conducted a study on 200 adolecents of USA. It was found that 34 per cent of total energy was supplied by fat. Energy intake of boys was greater than girls but contribution of energy from protein, fat and carbohydrate was same for both sexes (Michaud *et al.*, 1991 and Spyckerelle *et al.*, 1991).

According to Nagi *et al.* (1994) the mean daily intake of energy, protein, iron and ascorbic acid of adolescent girls of Ludhiana city was inadequate and the

intakes of fibre was sufficient when compared to ICMR recommended nutrient intakes. Zeszyty *et al.* (1994) conducted a survey among adolescents and found that the daily intakes of energy and carbohydrates were 6-25 and 1-26 per cent above the recommended. The author also reported deficits in the consumption of calcium, vitamin A, ascorbic acid and α tocopherol and fibre. Kochhar *et al.* (1995) found that the diet consumed by adolescent girls of Punjab was deficient in energy, protein and iron but contained higher amounts of calcium and thiamin than ICMR recommendations. They also reported that income significantly influenced energy, protein, iron, beta-carotene, riboflavin and ascorbic acid consumption.

Samuelson *et al.* (1996a) reported that on week days and week ends considerable energy was obtained from light meals and snacks. He found that nearly 40 per cent of the adolescent girls and 28 per cent of the boys had an energy intake from fat less than 30 per cent. The nutrient intake among adolescent girls belonging to poor socio-economic groups of rural areas of Rajasthan showed that the diets were 23-36 per cent deficient in energy and 23-32 per cent deficient in protein (Chaturvedi *et al.*, 1996). Rao (1996) reported that calorie intake of adolescents in India was only around 70 per cent of RDA. Cole *et al.* (1997) conducted a study on Nigerian adolescent girls and found that the contributions of specific nutrients and individual meals to the total energy intake were from carbohydrates, proteins and fats, i.e., 59.2, 12.5 and 28.3 per cent of energy respectively. A study conducted by Lyhne (1998) in Danish adolescents revealed that the average daily energy intake was 9.4 MJ for girls and 12.4 MJ for boys. The

distribution of energy was 34 per cent from fat, 49 per cent from carbohydrate, 14 per cent from protein, 3 per cent from alcohol and 13 per cent from added sugar. Mean intake of energy, protein, vitamin B12, folic acid and iron was higher in the urban group compared to rural group of adolescents (Akkamahadevi *et al.*, 1998).

Calcium intake was inadequate among adolescent girls of USA (Matkovic *et al.*, 1990; Niedzwiedz *et al.*, 1992; Albertson *et al.*, 1997). Williams (1993) reported that 12-16 year old met or exceeded their RDA for protein, riboflavin and vitamin C by taking snacks between meals. He also reported that vitamin A, calcium and iron fell considerably below the standard. A study conducted by Premeela *et al.* (1995) in Andhra Pradesh found that adolescent girls had lower intake of protective foods compared to boys resulting in calcium and vitamin A deficiency. Manjula *et al.* (1995) reported that the mean intake of nutrients except fat, calcium and vitamin C for adolescents of Karnataka was less than the RDA suggested by ICMR. Calcium consumption during adolescence may influence the risk of osteoporosis in later life (Ryan *et al.*, 1997).

Himes *et al.* (1997) reported that the mean intakes of vitamin C, vitamin D, calcium and zinc was below the recommendations for adolescent girls. Harzel *et al.* (1998) reported that adolescence is a critical period for bone mass acceleration and adolescents had suboptimal intake of calcium. According to Devadas (2000) some adolescents have a tendency to reject milk and to respond to peer pressure by consuming soft drinks which will frequently lead to calcium : phosphorus ratio less than 1:1.

Paul (2001) revealed that among adolescent girls in Kerala the intake of calcium, thiamine, niacin and vitamin C was higher than the RDA but iron, retinol and riboflavin was lower than the recommended levels.

Daniel *et al* (1975) reported that the diets of adolescent girls in developing countries are insufficient to replace iron losses. He also found that iron intake of girls tended to decrease with maturation. Whitney (1990) observed that the nutrients adolescents most often fail to obtain are iron, vitamin A and folate. Salar *et al.* (1990) assessed iron status among adolescents in Spain and found that most of the subjects studied had total iron intake lower than RDA. Iron is a mineral particularly needed for adolescent girls. Menustral iron losses pre dispose her to iron deficiency anaemia (Williams, 1993). According to Brabin and Brabin (1993) for girls on marginal diets, an extended catch-up growth may lead to depletion of iron and vitamin A. Samuelson *et al.* (1996b) reported daily mean intake of iron in boys and girls as 18.7 and 14.2 mg respectively.

Macvean *et al.* (1997) found out that 22 per cent of males and 98 per cent of females among Scottish adolescents were below the Recommended Nutrient Intake (RNI) for iron. According to British Nutrition Foundation (1998) adolescents who start a poorly planned vegetarian diet and young slimmers may be at more risk of iron deficiency.

The percentage of iron, retinol, riboflavin and calcium met by adolescent boys and girls of Kerala were lower than RDA (Paul, 1993). Lyhne

(1998) reported that the intake of vitamin D, iodine and iron was low compared to recommended levels among adolescent girls.

2.5 Growth studies in adolescent girls

Growth spurt during adolescence varies in intensity and duration from individual to individual due to several factors such as heredity, environment, socio-economic status, illness and malnutrition in childhood (Satyavati and Agarwal, 1979). According to Devadas and Jaya (1984) growth in adolescence is continuous rather than periodic, gradual rather than cataclysmic. Gopalan (1989) stated that the term 'Adolescence' represents a hyperanabolic phase of growth mediated by hormonal factors and characterized by peak velocities of growth. Hoey *et al.* (1986) stated that growth during adolescence contributes to the average female adult, approximately 15 per cent of her height and 40 per cent of her weight. National Nutrition Monitoring Bureau (NNMB, 1990) reported that between 14^{th} and 18^{th} year girls gain on an average 6.0 kg in the body weights and 4 cm in their heights. Female children during 11-15 years are with higher weight/height^2 than male children (Rao *et al.*, 1993). Watt and Sheiham (1996) reported that more adolescent girls compared with boys have been shown to be concerned about their weight. According to Dea *et al.* (1996) girls had a higher mean standard body weight than boys and boys were taller than girls. According to Bhat *et al.* (1998) the overall gain in weight and stature between 10 and 15 years was 16.8 kg and 20.3 cm respectively.

Tamilarasi and Sasirekha (1990) opined that adolescents with special reference to girls are concerned about their weight. Hill *et al.* (1992) reported that a "desire for thinness" resulting in inappropriate dieting and weight loss practices is well-recognized phenomenon amongst adolescent females. According to Dea (1996) girls were more likely to use weight control practices. Pubescent adolescents had greater BMI and pubescent girls were more likely to perceive themselves as overweight and desire a lower body weight compared with prepubescent girls. Nowak *et al.* (1996) surveyed 791 adolescents in Australia and found that only 41 per cent of girls and 54 per cent of boys were satisfied with their weight, 52 per cent of girls and 27 per cent of boys wanted to lose weight and 35 per cent of girls and 22 per cent of boys were trying to lose weight. Slimming methods reported included 'avoiding sugary foods', exercising, skipping meals, dieting, smoking, inducing vomiting, avoiding red meat, avoiding snacks, drinking water to decrease hunger, using laxatives and using diet pills (Ryan *et al.*, 1997).

Chaturvedi *et al.* (1996) assessed the nutritional status of adolescent girls by measuring the body mass index and found that 8.1 per cent of girls suffered from chronic energy deficiency (CED) grade I, 6.6 per cent grade II CED, and 78.8 per cent grade III CED in the age group of 10-18 years. Brabin *et al.* (1997) from the mean height and weight of adolescent girls observed that 10.4 per cent rural and 4.7 per cent of urban girls were stunted. Girls with a haemoglobin less than 10.0 g/100 ml were more likely to have a low body mass index than those with haemoglobin value greater than or equal to 10.0 g/100 ml. By using the body

mass index for determining the nutritional status of the Saudi Arabia adolescent girls it was found that 11 per cent of girls were under weight, 61 per cent were normal and 28 per cent were over weight or obese (Abahussain *et al.*, 1999). Shahabuddin *et al.* (2000) in their study on adolescent children observed that 67 per cent of adolescents were thin (75% boys and 59% girls) and 48 per cent stunted.

According to Robert *et al.* (1977) age at menarche is an important indicator of physiological development in females. Bhargava and Duggal (1981) opined that adolescent growth spurt and the age of menarche are influenced by the nutritional status during early adolescence. Kulin *et al.* (1982) observed that in case of rural adolescent girls menarche was delayed by 1.5 to 2 years but also noted that they were on lower level of anthropometric measurements at all ages when compared to urban affluents. According to Rana *et al.* (1984) children who attained menarcheal age were found taller and heavier than those who have not attained menarche. Sylvia and Premkumari (1993) stated that age at menarche varied within and between the population groups. Menarche occurs one year after the period of rapid growth – the growth spurt. Lenthe *et al.* (1996) reported that individuals who matured rapidly in adolescence were, in general, more obese and hence had high BMI than slowly maturing adolescents.

Bielicki *et al.* (1986) stated that with decreasing social class menarcheal age increases. According to Taneja *et al.* (1991) the mean age of menarche in the upper income and middle-income group was 13.76 and 14.6 years respectively.

When the age of menarche was delayed a high percentage of girls from both the groups failed to reach their growth potential as regards to weight for age. Cachera *et al.* (2000) reported that girls from low socio-economic group had low attained weight, height and a higher menarcheal age (15.4 years) than girls from higher socio-economic group (12.1 years). According to Parveen and Beegum (2001) age at menarche is influenced by genetic as well as environmental factors. The mean age at menarche was found to be 12.4 ± 4.2 years although the early age was 10 and later age was 16 years. 64 and 100 per cent of girls attained menarche by 12 and 16 years respectively. Nutritional status was also found to affect age at menarche. Malnourished girls had delayed menarcheal age (12.9 ± 1.0 years) as compared to normal girls (12.2 ± 1.0 years).

2.6 Nutritional status and endurance capacity of adolescent girls

According to Krolner *et al.* (1983) endurance exercise is an activity that typically comprises repetitive movements involving low muscle forces. Latchie (1993) defines endurance as the ability to repeat muscular contractions without fatigue.

Johnson and Nelson (1982) opined that nutrition play an important role in health and physical performance. Wheeler (1983) stated that nutritional status of an individual has direct and identifiable effect on his or her productivity at work. Proper nutrition forms the foundation for physical performance (Nutrition Reviews, 1984). According to Dirix *et al.* (1988) general physical capacity is the possibility of an active muscular system to deliver the necessary energy for the greatest mechanical work and to maintain it as long as possible. As stated by

Williams *et al.* (1994) interest in the influences of food on the capacity for physical activity is as old as mankind. According to Venkatalakshmi and Peramma (2000) better nutrition is definitely beneficial to the working population groups and increasing their body weight can remarkably increase their work capacity.

Various factors such as age, nutritional status in terms of BMI, low haemoglobin level, morbidity pattern and ultimately socio economic status affects work performance (Rajkumar and Premakumari, 2000).

Dallman and Willtes (1987) observed beneficial effects on endurance, resistance to fatigue, recovery from exertion or muscular strength and dexterity with a surplus of B complex vitamins in the diet.

Satyanarayana (1989) reported that a good physical work capacity can also be considered as an indicator of caloric and iron intake and resulting nutritional status. Edmunson and Sukhatme (1990) viewed that the major problem of lower energy intake is not only the endemic starvation or restricted economic productivity, but also results in marginal reserves in the body, which will not be sufficient to meet the additional stress. Srijaya and Rani (2000) found that anaemic subjects were in 100 per cent negative energy balance when compared to normals. Endurance capacity was also significantly lower than normals.

Baker (1978) reported that mild anaemia and possibly even iron deficiency in the absence of anaemia can reduce the maximum level of work. He has further observed that, severe anaemia limits the oxygen carrying capacity of the blood, which in turn limit the work output. Studies on school children indicate

moderate and mild anaemia resulting significantly more time to complete physical fitness test compared to normal children National Institute of Nutrition (NIN, 1986). Vijayalakshmi and Jayanthi (1986) conducted a study and the results indicated that iron supplementation conserves energy and the work output is increased after supplementation suggesting that anaemia decreases productivity and supplementation with iron improves work output. Bhatia (1987) reported that anaemic subjects have higher heart rate than normal subjects for the same type of work and had poor endurance capacity. According to Seshadri (1988) even mild iron deficiency anaemia reduces work capacity and decreases oxygen availability with subsequent load on the heart to pump more blood thereby increasing heart rate.

Murthy *et al.* (1989) conducted a study among children and women of 6 to 26 years old and it was noted that endurance capacity of mild anaemic participants were not reduced much but moderate and severe form of anaemia reduce the endurance very badly and an increase in time was taken to complete the exercise. According to Augustine (1993) anaemic subjects have to use higher heart rates for the same level of work compared to normal subjects and thus have poor endurance capacity. The haemoglobin in the red blood cells is indispensable for delivering oxygen for the process that use it in releasing energy from nutrients. Without adequate oxygen an active person cannot perform aerobic activities and tires easily (Rolfer *et al.*, 1998).

According to Ash and Nelson (1998) reduced haemoglobin levels are associated with decreased physical activity. One consequence of iron deficiency anaemia in adolescent girls may be the establishment of poor physical activity patterns with implications for future adult health. Radha and Chandrasekhar (2000) reported that lower physical work capacity improved with improvement in their haemoglobin levels on iron supplementation. Suman (2000) found from her study that 55 percentage of adolescent girls had poor functional performance and a low average was observed in 45 percentage of them.

Materials and Methods

3. MATERIALS AND METHODS

The study on the "Nutritional profile and endurance capacity of adolescent girls" was carried out to find out the nutritional status of school going adolescent girls (13-15 years) and to assess the effect of nutritional status on their endurance capacity.

3.1 Selection of the study area

The study was conducted in Ollukkara block.

From the list of Government high schools in Ollukkara block three high schools were randomly selected for the study.

3.2 Selection of the samples

Two stage simple random sampling was the sampling design adopted. High schools were the first stage units and the adolescent girls, the second stage units. Selection was made by simple random sampling without replacement at both the stages. Sample size was three at the first stage and at the second stage the total sample size was fixed at 150. Number of adolescent girls to be selected from each school was in proportion to the total number of adolescent girls in the school. A subsample of 30 girls (10 from each school) were randomly selected from the above sample for conducting clinical examination, estimating the blood haemoglobin level and for assessing their endurance capacity. Food weighment survey was carried out in a subsample of 15 girls (five girls from each school selected at random from the subsample of ten girls selected for clinical examination).

3.3 Plan of action (Research plan)

Plan of action of the present study included

1. A baseline survey to collect the socio-economic details of the families of the adolescent girls and also to collect details of the adolescents who are selected for the study.
2. A dietary survey to assess the food consumption pattern of the families especially the dietary habits of the adolescent girl in the family.
3. Assessment of nutritional status of selected adolescent girls by conducting
   a) An anthropometric survey to record height and weight
   b) Clinical examination of the subsample to identify manifestation of symptoms related to malnutrition.
   c) Estimating the blood haemoglobin levels in the sub sample.

d) A one day food weighment survey in a sub sample of 15 girls to determine the actual food and nutrient intake.

4. Assessment of endurance capacity of the adolescent girls (sub sample 30) through standard procedures.
5. Analysis of the data using suitable statistical techniques to find out the influence of nutritional status on endurance capacity.

3.4 Methods selected for the study

The method adopted for obtaining the data pertaining to the socio-economic status, dietary habits of the families and adolescent girls was by interviewing with the help of a schedule.

According to Wilkinson and Bhandarkar (1979), the interview method can be made to yield an almost perfect sample of the general population, and the information secured is likely to be more correct compared to that secured through other techniques. The advantages of interview method is that it is a much more flexible approach, it consists of face to face verbal interchange, it is not a time consuming method and therefore large number of families can be covered in a specific time.

According to Thimmayamma and Rau (1996) diet is a vital determinant of health and nutritional status. Diet surveys are mainly of two types, one which concentrates on qualitative aspects of the foods, i.e., what kinds of foods are eaten, and the other which attempts to estimate the amounts of food consumed in quantitative terms, i.e. how much of food is eaten. Both this types were included in this study to elicit information regarding the dietary habits and food and nutrient intake of the adolescent girls.

According to Rao and Vijayaraghavan (1996) nutritional anthropometry is, measurement of human body at various ages and levels of nutritional status. It is based on the concept that an appropriate measurement should reflect any morphological variation occurring due to a significant functional physiological change.

Measurements of weights at various ages have been used as an index of nutritional status and have proved very valuable when correctly interpreted (Beegum, 1991).

Among the environmental factors, which influence the height of an individual, nutrition and morbidity are very important because inadequate dietary intake or infections reduce nutrient availability at cellular level leading to growth retardation and stunting (Rao and Vijayaraghavan, 1996). In the present study anthropometric measurements such as height and weight were recorded using standard methods.

Clinical examination is an important and sound method of assessing the nutritional status of a community. It gives direct information on signs and symptoms of dietary deficiencies prevalent (Jelliffee, 1966 and Kamath, 1986). In this study also clinical examination of adolescent girls was conducted by a physician.

Biochemical estimation of haemoglobin was carried out by cyanmethaemoglobin method (NIN 1983).

Rao (1975) stated that any single day or two day weighment method could be as efficient as tool as that of seven days. Hence in this study a one-day food weighment survey was conducted among the sub sample of 15 adolescent girls. The exact amount of food consumed by the adolescent girl and nutritive value of the foods consumed were computed.

According to Satyanarayana (1989) a good physical work capacity can also be considered as an indicator of calorie and iron intake and resulting nutritional status. Nutritional deprivation appeared to impair work capacity, physical fitness and the capacity to handle moderate workloads. The functional

performances of adolescent girls were measured by Harvard step test suggested by Brouha (1943).

3.5 Development of tools

To elicit information regarding the socio-economic and dietary pattern of the families interview method was used. The interview schedule for obtaining the socio economic characteristics of the families were structured to include data on income and expenditure pattern of the families, religion and educational level of the parents, family size, nature of the family, living conditions, details regarding the adolescent girl like birth order, morbidity pattern, age at menarche, involvement in household duties, practicing exercise/yoga etc. The pretested questionnaire is presented in Appendix-I.

A separate schedule was developed to elicit information on food habits and food consumption pattern of the families which included the details regarding the dietary habits of the families mainly food expenditure pattern, frequency of use of various foods, eating habits of the adolescent girl and food preferences. The pretested schedule is presented in Appendix-II.

Suitably structured schedule was also developed for clinical examination and is presented in Appendix-III.

Separate schedules were structured for food weighment survey and is presented in Appendix-IVa and IVb. Standardised food weighing balance and standard measuring cups and spoons were used for conducting the food weighment.

Endurance capacity was measured by using a bench of 16-inch height and stop clock.

3.6 Conduct of the study

3.6.1 Survey of socio-economic and dietary pattern of the families and that of adolescent girl in the family

The informations on the socio economic and dietary pattern of the families were collected with the help of pretested schedules by interview method. Here the respondents were adolescent girls in the age group of 13-15 years and their parents. The accuracy of the answers were checked by supplementary questions whenever necessary.

3.6.2 Anthropometric survey

In this study heights and weights of 150 adolescent girls were recorded using standardized procedures.

Height of the girls were measured by using a fiber glass tape. The subject was asked to stand erect without shoes, with the heels, buttock, shoulder and occiput against the wall.

Weight of the girls were recorded using a bathroom balance, which was checked by caliberation with standard weights.

3.6.3 Clinical examination

Clinical examination was conducted with the help of a physician.

3.6.4 Estimation of haemoglobin

In this study biochemical estimation of blood for haemoglobin was carried out to identify the prevalence of anaemia. This was carried out using

cyanmethaemoglobin method was suggested by National Institute of Nutrition (NIN, 1983). The procedure is given in Appendix-V.

3.6.5 Food weighment survey

To assess the actual food and nutrient intake of adolescent girls, a one-day food weighment survey was conducted in a sub sample of 15 girls. The weight of raw ingredients included in the meal for a day and the weight of cooked foods prepared by the family were recorded. Any other extra foods consumed by the girls like snacks, biscuits, toffees etc. outside the house was also recorded. All these weights were taken with standard measuring cups and spoons and also by means of a food weighing balance. The amount of cooked food consumed by the child was then converted to its raw equivalents. This was conducted for one day and the nutritive value of the food consumed was computed using food composition table (Gopalan *et al.*, 1989).

3.6.6 Endurance capacity

The functional performances of adolescent girls were assessed by Harvard step test suggested by Brouha (1943). In this test the subject performed a stepping exercise on a 16-inch bench for 4 minutes. The lead foot may be changed during the test, but not more than three times. Immediately after completion of the exercise the tester sits down for 1 minute and the pulse count is taken at 1 minute, 2 minute and 3 minute for a duration of 30 seconds. For incomplete subjects the pulse count is taken at 2, 2½ and 3rd minute for a duration of 30 seconds. And with this the index was worked out using the equation given below.

$$\text{Index} = \frac{\text{Duration of exercise in seconds}}{2.2 \times \text{pulse count}} \times 100$$

3.6.7 Interpretation of data

To interpret the results the data was analysed using suitable statistical techniques such as students 't' test, correlation analysis and regression analysis.

Results

4. RESULTS

The results of the study on the "Nutritional status and endurance capacity of adolescent girls" are presented under the following headings.

4.1 Socio-economic background of families and details regarding the adolescent girl

4.2 Food consumption pattern of families and dietary habits of adolescent girls

4.3 Nutritional status of adolescent girls assessed by

a) Anthropometric measurements

b) Clinical examination

c) Haemoglobin levels

d) Food weighment survey

4.4 Endurance capacity of adolescent girls

4.1 Socio-economic background of families and details regarding the adolescent girl

Distribution of families based on religion, type of family and family size are presented in Table 1.

Table 1 reveals that 58.67 per cent of the families surveyed were Hindus, 37.33 per cent were Christians and 4 per cent were Muslims. Among Hindus majority (69.33%) belonged to other backward community, 22.67 per cent belonged to scheduled caste and 8 per cent belonged to forward community.

The table further reveals that majority of the families (67.33%) followed nuclear family system while 32.67 per cent followed joint family system.

Table 1. Distribution of families based on religion, type of family and family size

Details	Number of families (n=150)
Religion	
a) Hindus	88 (58.67)
1.Forward community	7 (8.00)
2. OBC	61 (69.33)
3. SC	20 (22.67)
b) Christians	56 (37.33)
c) Muslims	6 (4.00)
Total	150
Type of family	
Joint	49 (32.67)
Nuclear	101 (67.33)
Family size	
Number of adults	
1-2	101 (67.33)
3-4	45 (30.00)
4-5	3 (2.00)
> 5	1 (0.67)
Number of children	
1	2 (1.33)
2	85 (56.67)
3	51 (34.00)
4	12 (8.00)

Figures in parenthesis indicate percentage

Regarding the family size most of the families (67.33%) had 1-2 adults and 30 per cent had 3-4 adults. About 2 per cent of the families had 4-5 adults and 0.67 per cent had more that 5 adults. Number of children were limited to two in 56.67 per cent of the families. Thirty four per cent of the families had three children and 8 per cent had four children. Only one child was observed in 1.33 per cent of the families.

Educational status of parents are shown in Table 2.

Table 2. Educational status of parents

Educational status	Number of families (n=150)	
	Father	Mother
Illiterate	-	-
Lower Primary	27 (18.00)	23 (15.33)
Upper primary	54 (36.00)	50 (33.33)
High School	63 (42.00)	67 (44.67)
College	6 (4.00)	10 (6.67)
Total	150 (100)	150 (100)

Figures in parenthesis indicate percentage

In 42 per cent of the families, fathers had high school level of education. Thirty six per cent of the fathers had upper primary level education, while 18 per cent of fathers had only lower primary level education. Fathers with college level education were at a minimum of 4 per cent.

Educational status of mothers revealed that 44.67 per cent of them had high school education, 33.33 per cent of the mothers studied upto upper primary level and 15.33 per cent had lower primary level education. It was observed that 6.67 per cent of mothers had college level education.

Occupational status of parents are presented in Table 3.

Table 3. Occupational status of parents

Occupational status	Number of families (n=150)	
	Father	Mother
Permanent Job	22 (14.67)	5 (3.33)
Temporary Job	22 (14.67)	8 (5.33)
Agriculture	20 (13.33)	-
Business	22 (14.67)	-
Labourers	60 (40.00)	22 (14.67)
Unemployed	4 (2.67)	115 (76.67)
Total	150 (100)	150 (100)

Figures in parenthesis indicate percentage

Table 3 reveals that 40 per cent of fathers were working as labourers and 14.67 per cent of them were having permanent and temporary jobs. Another 14.67 per cent of fathers were engaged in different types of business activities, 13.33 per cent of the fathers were occupied in agriculture while in 2.67 per cent of the fathers were found to be unemployed.

Regarding the occupational status of mothers majority of them (76.67%) were unemployed. About 14.67 per cent of the mothers were working as labourers. About 3.33 per cent of mothers were having permanent jobs and 5.33 per cent of them had temporary jobs.

Details regarding monthly income of families are presented in Table 4.

Table 4. Monthly income

Monthly income (Rs.)	Number of families (n=150)
Upto 2000	74 (49.33)
2001-4000	58 (38.67)
4001-6000	12 (8.00)
6001-8000	2 (1.33)
8001-10000	4 (2.67)
Total	150 (100)

Figures in parenthesis indicate percentage

Table 4 shows that roughly about half of the families had monthly income less than Rs.2000 of monthly income, 38.67 per cent of the families ranged between Rs.2001 and 4000. Eight per cent of the families had monthly income between Rs.4001 and Rs.6000 and 2 per cent had monthly income between Rs.6001 and Rs.8000. In 2.67 per cent of the families the monthly income was between Rs.8001 and Rs.10,000.

Details regarding monthly expenditure pattern of the families on food, clothing, shelter, rent, transport, education and entertainment are given in Table 5a and the expenditure on savings, health, personal expenditures, repayment of loans, 'kuries', fuels and other needs of the family are revealed in Table 5b.

Table 5a. Distribution of families based on monthly expenditure pattern

Range of monthly expenditure (in percentage)	Percentage of families						
	Food	Clothing	Shelter	Rent	Transport	Educat-ion	Entertain-ment
<9	-	83.33	18	-	98.67	72.67	54
10-19	4.00	16.67	-	1.33	1.33	27.33	0.67
20-29	10.67	-	0.67	-	-	-	-
30-39	17.33	-	-	-	-	-	-
40-49	18.67	-	-	-	-	-	-
50-59	26.67	-	-	-	-	-	-
60-69	17.33	-	-	-	-	-	-
>70	5.33	-	-	-	-	-	-
Nil	-	-	81.33	98.67	-	-	45.33

Table 5b. Distribution of families based on monthly expenditure pattern

Range of monthly expenditure (in percentage)	Percentage of families						
	Savings	Health	Personal expenses	Repayment of loans	Kuries	Fuels	Others
<9	28.67	80.67	51.33	4.00	67.33	92.00	20
10-19	21.33	-	14.00	3.33	18.00	8.00	-
20-29	5.33	-	2.67	6.67	2.00	-	-
30-39	8.00	-	-	4.00	7.00	-	-
40-49	-	-	-	2.00	-	-	-
50-59	0.67	-	-	-	-	-	-
60-69	-	-	-	-	-	-	-
>70	-	-	-	-	-	-	-
Nil	36	19.33	32.00	80.00	12.00		80

Table 5a reveals that majority of the families spent more than 30 per cent of their income on food. About 18.67 per cent of the families spent 40-49 per cent of their monthly income on food whereas 26.67 per cent of the families spent upto 59 per cent of their income on food. Food expenditure was observed upto 69 per cent in 17.33 per cent of the families and even above 70 per cent of income

was found as food expenditure in 5.33 per cent of the families studied. Majority of the families (83.33%) spent less than 10 per cent of their income on clothing whereas 16.67 per cent spent 10 to 20 per cent on clothing. Regarding the expenditure for shelter majority of the families (81.33%) had no expenditure on this account. About 18 per cent of the families had expenditure below 10 per cent whereas 0.67 per cent of the families spent 20 to 29 per cent of their income on shelter.

Expenditure on rent was found to be incurred by 1.33 per cent of families for this families it was upto 19 per cent of their income. Most of the families (98.67%) had no expenditure under this head.

Majority of the families (98.67%) spent less than 9 per cent of their monthly income for transportation. The remaining 1.33 per cent spent 10 to 19 per cent of their monthly income for the same purpose.

As observed most of the families (72.67%) spent only upto 10 per cent of their income for the education of their children while for 27.33 per cent of the families, expenditure on education was found to be in between 10 to 19 per cent.

It is clear from the table that 54.67 per cent of the families spent less than 20 per cent of their monthly income for entertainment whereas 45.33 per cent of the families had no expenditure in this account.

As shown in Table 5b, it was observed that 36 per cent of the families had no savings from their monthly income, while 28.67 per cent saved less than 10 per cent of their monthly income. Ten to 19 per cent of monthly income was saved

by 21.33 per cent of the families. Only 8.67 per cent of the families saved more than 30 per cent of their monthly income for their future expenses.

All, except 19.33 per cent of the families spent less than 10 per cent of their monthly income for health aspects.

About 51.33 per cent of the families spent less than 10 per cent of their monthly income to meet the personal needs of family members. Fourteen per cent of the families spent 10-19 per cent and 2.67 per cent spent 20-29 per cent of their monthly income for the same purpose. Thirty two per cent of the families reported no expenditure for this purpose.

Eighty per cent of the families were free from repayment of loans. About 20-29 per cent of the monthly income was used for the repayment of loans by 6.67 per cent of the families. Four per cent of the families used 30-39 per cent and 2 per cent used 40-49 per cent of their monthly income for repayment of loans.

One of the most popular method of saving money was found to be in 'kuries'. Majority of the families (67.33%) used upto 9 per cent of their income for remitting in the 'kuries'. Eighteen per cent of the families deposited 10-19 per cent and 2 per cent of the families deposited 20-29 per cent of monthly income in 'kuries'. About 12 per cent of the families were not having any 'kuries'.

Monthly expenditure pattern on fuel revealed that 92 per cent of families spent less than 9 per cent of their monthly income for fuel and 8 per cent spent 10 to 19 per cent for the same purpose. Twenty per cent of the families spent

less than 10 per cent of their income for other purposes such as phone and water charges and other unforeseen expenditures etc.

Housing conditions of the families such as ownership of house, number of rooms, type of roof, type of wall, type of floor etc. are presented in Table 6.

Table 6. Housing conditions

Details	Number of families (n=150)
1. Ownership of house	
Own	144 (96.00)
Rented	6 (4.00)
2. No. of rooms	
1-2	43 (28.67)
3-5	83 (55.33)
6-8	23 (15.33)
8 and more	1 (0.67)
3. Type of roof	
Thatched	19 (12.67)
Tiled	86 (57.33)
Concrete	45 (30.00)
4. Type of wall	
Mud	2 (1.33)
Stone	34 (22.67)
Brick	114 (76.00)
5. Type of floor	
Tiled	1 (0.67)
Concrete	102 (68.00)
Mosaic	9 (6.00)
Cowdung	38 (25.33)
6. Separate kitchen	
Yes	130 (86.67)
No	20 (13.33)

Figures in parenthesis indicate percentage

From Table 6 it was found that 96 per cent of the families had their own house. Regarding the number of rooms in the house 3-5 rooms were found in 55.33 per cent of the families. One to two rooms were seen in the houses of 28.67 per cent of the families while for 15.33 per cent of the families, the house had 6-8 rooms. Only 0.67 per cent of the houses had more than 8 rooms.

Regarding roofing conditions, most of the houses (57.33%) were tiled and concrete houses were also found (30%). Thatched roof was also found in 12.67 per cent of the houses. Majority of the families (76%) had their houses built with bricks. About 22.67 per cent of the houses were built with stone and 1.33 per cent of families had their houses built with mud. Concrete flooring was found in 68 per cent of the families. Cow dung was also used as a flooring material in 25.33 per cent of the families. Mosaic and tiled flooring was observed in 6 and 0.67 per cent of the houses respectively.

Most of the families (86.67%) had separate kitchen in their house. In about 13.33 per cent of the families, a part of a room was used as cooking area.

Other living facilities which included sources of drinking water, lavatory, drainage, electricity facilities etc. are presented in Table 7.

From the above table it was observed that 61.33 per cent of the families had their own well as the source of drinking water. Fourteen per cent of the families depended on public taps while 12 per cent depended on public wells as their source of water. The remaining 12.67 per cent of the families depended on their neighbours well as their source of drinking water.

Table 7. Other living facilities

Details	Number of families (n=150)
1. Source of drinking water	
Own well	92 (61.33)
Public tap	21 (14.00)
Public well	18 (12.00)
Others	19 (12.67)
2. Lavatory facilities	
Own latrine	149 (99.33)
Public latrine	-
Open	1 (0.67)
3. Drainage facilities	
Present	133 (88.67)
Absent	17 (11.33)
4. Electricity	
Present	128 (85.33)
Absent	22 (14.67)
5. Information sources/Recreational facilities	
Newspaper, magazine, radio, television & VCR	3 (2.00)
Newspaper, magazine and radio	3 (2.00)
Newspaper, radio and television	2 (1.33)
Radio, television and VCR	5 (3.33)
Radio and television	26 (17.33)
Newspaper and Radio	3 (2.00)
Newspaper and television	1 (0.67)
Radio	49 (32.67)
Television	7 (4.67)
6. Labour saving devices	
Present	48 (32.00)
Absent	102 (68.00)

Figures in parenthesis indicate percentage

Almost all families (99.33%) had their own lavatory facilities. Majority of the houses (88.67%) had good drainage system while 11.33 per cent of the

houses were not having this facility. Electric connections were available for 85.33 per cent of the families.

It was found that 32.67 per cent of the families had radio and 17.33 per cent of the families possessed both a radio and television as their source of information and recreation.

Only 32 per cent of the families were found to possess labour saving devices such as mixi and pressure cooker whereas majority of the families (68%) had no such labour saving devices.

Details regarding the type of fuel used for cooking by the families are given in Table 8.

Table 8. Type of fuel used for cooking

Details	Number of families (n=150)
Wood, kerosene and cooking gas	2 (1.33)
Wood and kerosene	63 (42.00)
Wood and cooking gas	35 (23.33)
Wood	48 (32.00)
Cooking gas	2 (1.33)
Total	150 (100)

Figures in parenthesis indicate percentage

Forty two per cent of families used both wood and kerosene as their main fuel for cooking. It was observed that 32 per cent of families depended only on wood for cooking, while 23.33 per cent depended on both wood and cooking gas as their fuel.

Personal details regarding the selected adolescent girls in families are given in Table 9.

Table 9. Personal details of selected adolescent girls

Details	Number of girls (n=150)
Age	
13 years	73 (48.67)
>13- ≤14 years	66 (44.00)
>14- ≤15 years	11 (7.33)
Birth weight (kg)	
<2.5	18 (12.00)
2.5-3	101 (67.33)
>3	31 (20.67)
Birth order	
1st	60 (40.00)
2nd	61 (40.67)
3rd	24 (16.00)
4th	5 (3.33)
Age at menarche (years)	
Not yet	30 (20.00)
<11	-
12	27 (18.00)
13	60 (40.00)
14	32 (21.33)
>14	1 (0.67)

Figures in parenthesis indicate percentage

The above table reveals that 48.67 per cent of the girls were of 13 years of age, 44 per cent were between 13 to 14 years, and the rest of them (7.33%) were between 14-15 years of age.

Majority of the girls (67.3%) had their birth weight in the range of 2.5 to 3 kg. Twelve per cent of the girls had birth weight less than 2.5 kg and in 20.67 per cent girls birth weight was recorded above 3 kg. Regarding the birth order 40 per cent of the girls belonged to the first birth order, 40.67 per cent to second birth

order and 16 per cent to the third birth order. The remaining 3.33 per cent of girls belonged to the fourth birth order.

Details of age at menarche presented in the above table shows that 40 per cent of the girls attained their first menstruation by the age of 13 years and 21.33 per cent by 14. For 18 per cent of girls their age at menarche was found to be twelve. Age at menarche was found to be above 14 years in 0.67 per cent of girls. Twenty per cent of the girls surveyed had not yet attained their menarche.

Morbidity pattern of adolescent girls for the last one year are presented in Table 10.

Table 10. Morbidity pattern of adolescent girls

Details	Number of girls (n=150)
Diarrhoea/Vomiting	11 (7.33)
Measles	4 (2.67)
Chicken pox	-
Mumps	3 (2.00)
Fever	135 (90.00)
Jaundice	1 (0.67)
Respiratory diseases	8 (5.33)
Others (Tuberculosis)	2 (1.33)

Figures in parenthesis indicate percentage

As observed from Table 10, 90 per cent of the girls had fever and 7.33 per cent had diarrhoea and vomiting. Respiratory diseases were found among 5.33 per cent of girls. Diseases like measles and mumps were found in 2.67 per cent and 2 per cent of the girls, respectively. Other diseases like tuberculosis was observed among 1.33 per cent of girls.

Involvement of girls in household chores like washing clothes, washing utensils, sweeping, gardening, cooking and care of the younger siblings are presented in Table 11.

Table 11. Involvement of adolescent girls in household chores

Details	Number of girls (n=150)
Washing clothes, washing utensils, sweeping, gardening, cooking are care of younger siblings	67 (44.67)
Washing clothes, washing utensils, sweeping, gardening and cooking	24 (16.00)
Washing clothes, washing utensils, sweeping, gardening and care of younger siblings	9 (6.00)
Washing clothes, washing utensils, sweeping, cooking and care of younger siblings	8 (5.33)
Washing clothes, washing utensils, gardening, cooking and care of younger siblings	2 (1.33)
Washing utensils, sweeping, gardening, cooking and care of younger siblings	1 (0.67)
Washing clothes, washing utensils, sweeping and cooking	13 (8.67)
Washing clothes, washing utensils, sweeping and gardening	13 (8.67)
Washing clothes, washing utensils, sweeping and care of younger siblings	1 (0.67)
Washing utensils, sweeping, gardening and care of younger siblings	1 (0.67)
Washing clothes, sweeping, gardening and cooking	1 (0.67)
Washing clothes, washing utensils, cooking and care of younger siblings	1 (0.67)
Washing clothes, washing utensils and sweeping	4 (2.67)
Washing clothes, washing utensils and gardening	2 (1.33)
Sweeping, gardening and cooking	1 (0.67)
Sweeping, gardening and washing utensils	1 (0.67)
Washing clothes, washing utensils and care of younger siblings	1 (0.67)

Figures in parenthesis indicate percentage

From the above table it is clear that all the adolescent girls were involved in one or other type of household chores. About 44.67 per cent of the girls were involved in all the household chores like washing clothes, utensils, sweeping the floor, cooking, gardening and care of the younger siblings.

Involvement of adolescent girls in other physical activities is presented in Table 12.

Table 12. Other physical activities of the girls

Details	Number of girls (n=150)
Provision for physical education in school	
Present	150 (100)
Absent	-
Participation in sports and games	
Yes	35 (23.33)
No	115 (76.67)
Participation in sports and games competitions	
Yes	21 (60.00)
No	14 (40.00)
Participation in entertainments	
Yes	53 (35.33)
No	97 (64.67)

Figures in parenthesis indicate percentage

As is evident from table 12, 100 per cent of girls had provision for physical education in school. Only 23.33 per cent of the girls participated in sports and games at school out of which 60 per cent of them participated in competitions at school level and district level. About 35.33 per cent of girls participated in various types of entertainments like dance.

Details regarding mode of travel of adolescent girls to their school are presented in Table 13.

Table 13. Details of travel to school

Details	Number of girls (n=150)
Mode of travel	
Walking	88 (58.67)
Bus	62 (41.33)
Cycling	-
Others	-
Total	150 (100)
Distance of travel	
Walking	
< ½ km	31 (35.23)
½ km - ≤1 km	39 (44.32)
> 1 km	18 (20.45)
Total	88 (100)
Bus	
< 5 km	28 (45.16)
> 5 - ≤ 10 km	20 (32.26)
> 10 km	14 (22.58)
Total	62 (100)

Figures in parenthesis indicate percentage

Table 13 reveals that more than half of the girls (58.67%) walked to their school while the rest (41.33%) went to school by bus.

In case of distance of travel it was observed that 44.32 per cent of the girls had to walk ½ to 1 km to reach school. The distance to walk was only less than ½ km for 35.23 per cent of girls whereas 20.45 per cent of the girls had to walk more than 1 km to reach school. Among girls travelling by bus 32.26 per cent of them had to travel 5-10 km daily to reach school. About 45.16 per cent had to travel only less than 5 kms whereas 22.58 per cent of the girls travelled more than 10 kms to reach school.

4.2 Food consumption pattern of the families and dietary habits of adolescent girls

4.2.1 Food consumption pattern of the families

Food habits and meal pattern of the families were studied and the details are presented in Table 14.

Table 14. Food habits and meal pattern of the families

Details	Number of families (n=150)
Food habit	
Vegetarian	0
Non-vegetarian	150 (100)
Planning meal in advance	
Yes	113 (75.33)
No	37 (24.67)
Meal pattern	
One major meal	-
Two major meals	19 (12.67)
Three major meals	131 (87.33)

Figures in parenthesis indicate percentage

All the families were found to use non-vegetarian foods. In most of the families it was the mother who decided the menu for the day. In 75.33 per cent of the families menu was planned in advance. Majority of the families (87.33%) followed three major meal pattern and 12.67 per cent of families followed two major meal pattern.

Distribution of the families based on their monthly food expenditure pattern is presented in Table 15a and Table 15b.

As revealed in Table 15a for 42 per cent of the families 40-49 per cent of food expenditure was for cereals. For 22.67 per cent of the families it was 30-39 per cent of the food expenditure. For 25.33 per cent of the families 50-59 per cent

of the food expenditure was for the purchase of cereals. Expenditure on cereals came upto 60 to 69 per cent of food expenditure for 8.67 per cent of families.

Table 15a. Food expenditure pattern of families (n=150)

Range of food expenditure (in percentage)	Percentage of families				
	Cereals	Pulses	Other vegetables	Green leafy vegetables	Roots and tubers
<9	-	78.00	65.33	63.00	82.00
10-19	0.67	22.00	34.67	-	18.00
20-29	0.67	-	-	-	-
30-39	22.67	-	-	-	-
40-49	42.00	-	-	-	-
50-59	25.33	-	-	-	-
60-69	8.67	-	-	-	-
>70	-	-	-	-	-
Nil	-	-	-	37	-

Table 15b. Food expenditure pattern of families (n=150)

Range of food expenditure (in percentage)	Percentage of families				
	Meat and chicken	Fish	Egg	Fruits	Milk
<9	37.75	55.33	90.00	88.33	17.33
10-19	46.00	44.67	5.33	11.67	46.00
20-29	0.67	-	-	-	15.33
30-39	-	-	-	-	0.67
40-49	-	-	-	-	-
50-59	-	-	-	-	-
60-69	-	-	-	-	-
>70	-	-	-	-	-
Nil	15.33	-	4.67	-	20.67

Food expenditure on pulses was only below 9 per cent for majority of the families (78%) and for the rest of the families expenditure on pulses was 10-19 per cent.

Expenditure on vegetables was also below 9 per cent for most of the families (65.33%) and for the rest of the families it was 10-19 per cent. For majority of the families (63%) expenditure on green leafy vegetables was observed

as below 9 per cent of food expenditure. About 37 per cent of the families recorded no expenditure for green leafy vegetables. In majority of the families (82%) expenditure on roots and tubers was also below 9 per cent whereas in 18 per cent of the families 10-19 per cent of the food expenditure was on roots and tubers.

As detailed in Table 15b for 46 per cent of the families 10-19 per cent of the food expenditure was for flesh foods like meat and chicken. In 37.75 per cent of families it was below 9 per cent. Food expenditure on flesh foods came to 20-29 per cent in 0.67 per cent of the families.

Expenditure on fish was found to be below 9 per cent in 55.33 per cent of the families and 10-19 per cent in 44.67 per cent of the families. Food expenditure on eggs was found to be below 9 per cent in 90 per cent of the families and in 5.33 per cent of the families it was between 10-19 per cent. No expenditure was observed for this food item by 4.67 per cent of the families.

For 88.33 per cent of the families expenditure on fruits was also found to be below 9 per cent. It came to 10-19 per cent for the rest of the families.

Regarding the food expenditure on milk, 46 per cent of the families spent 10-19 per cent on this item. Below 9 per cent expenditure was observed in 17.33 per cent of the families whereas for 15.33 per cent of the families 20-29 per cent of food expenditure was for the purchase of milk. Expenditure on milk came upto 30-39 per cent in 0.67 per cent of the families and in 20.67 per cent of families no expenditure was incurred with regard to this food item.

Most of the families (90%) were in the habit of drinking tea early in the morning. For breakfast, rice was served in the form of 'Kanji' or 'Choru' in 79 per cent of the families. Only in very few families rice preparations like pittu, idli and

dosa were prepared for breakfast. For breakfast with 'Kanji' or 'Choru' most of them prepared side dishes with roots and tubers, other vegetables or dhal.

Rice is the major preparation for all families during lunch. For lunch 60 per cent of the families prepared side dishes with dhal, other vegetables and roots and tubers and 24 per cent of the families prepared fish and egg for lunch. Very few families prepared green leafy vegetables and meat preparations for lunch.

During evening 83.33 per cent of the families consumed tea along with snacks and others consumed only tea.

Rice was served in 86.67 per cent of the families for dinner while in 13.33 per cent of families they prepared either rice or chapathi were served. Common side dishes prepared for dinner included dishes with dhal, other vegetables, roots and tubers and fish.

Table 16 deals with other food habits of the family.

Table 16. Other food habits of the family

Details	Number of families (n=150)
1. Family members having the habit of drinking milk while going to bed	
Yes	44 (29.33)
No	106 (70.67)
2. Consumption of raw foods	
Yes	148 (98.67)
No	2 (1.33)
a) Salads and fruits	37 (25.00)
b) Fruits	111 (75.00)
3. Specific time schedule for eating food	
Yes	27 (18.00)
No	123 (82.00)

Figures in parenthesis indicate percentage

It was found that in majority of the families (70.67%) there was no habit of drinking milk while going to bed. Consumption of raw foods, mainly fruits was observed in 98.67 per cent of the families. Eighty two per cent of the families were not having specific time schedule for eating food.

Frequency of use of various food items by the families are given in Table 17.

Table 17. Frequency of use of food items by the families

Food items	Frequency of use (Percentage of families)						
	Daily	W_4	W_3	W_2	W_1	Occ.	Never
Cereals	150 (100)	-	-	-	-	-	-
Pulses	11 (7.33)	17 (11.33)	25 (16.67)	86 (57.33)	10 (6.67)	1 (0.67)	-
Green leafy vegetables	-	1 (0.67)	4 (2.67)	6 (4.00)	26 (17.33)	107 (71.33)	6 (4.00)
Roots and tubers	1 (0.67)	1 (0.67)	5 (3.33)	67 (44.67)	52 (34.67)	20 (13.33)	4 (2.67)
Other vegetables	10 (6.67)	17 (11.33)	66 (44.00)	53 (35.33)	-	4 (2.67)	-
Fruits	2 (1.33)	1 (0.67)	1 (0.67)	2 (1.33)	24 (16.00)	120 (80.00)	-
Milk and milk products	73 (48.67)	1 (0.67)	1 (0.67)	5 (3.33)	19 (12.67)	47 (31.33)	4 (2.67)
Meat	-	-	-	2 (1.33)	35 (23.33)	110 (73.33)	3 (2.00)
Fish	10 (6.67)	11 (7.33)	37 (24.67)	52 (34.67)	35 (23.33)	4 (2.67)	1 (0.67)
Egg	1 (0.67)	1 (0.67)	4 (2.67)	10 (6.67)	65 (43.33)	65 (43.33)	4 (2.67)
Fats and oils	150 (100)						
Sugar/Jaggery	150 (100)						

Figures in parenthesis indicate percentage
Wi – 'i' times a week, i = 1, 2, 3, 4; Occ - Occasionally

All the families used foods such as cereals, fats and oils and sugar and jaggery daily.

Regarding the consumption of pulses 57.33 per cent of the families consumed it twice a week. About 16.67 per cent of the families consumed pulses thrice a week and 11.33 per cent consumed pulses four times a week. Pulse consumption was limited to once in a week by 6.67 per cent of the families. Only 7.33 per cent of the families consumed pulses daily.

Green leafy vegetables were consumed occasionally by 71.33 per cent of families. About 17.33 per cent of families consumed it once a week and 4 per cent consumed it twice a week. Daily consumption of green leafy vegetables was not observed in any of the families while 4 per cent of families never included it in their diet. About 2.67 per cent of families used this food item three times a week and 0.67 per cent consumed it four times a week.

Daily consumption of roots and tubers was restricted to 0.67 per cent of the families. The pattern of consumption was found to be weekly once (34.67%), weekly twice (44.67%), weekly thrice (3.33%) and four times a week (0.67%) by the families. Occasional consumption of roots and tubers was reported by 11.33 per cent of families.

Daily consumption of other vegetables was found only in 6.67 per cent of the families. About 35.33 per cent consumed it twice a week while 44 per cent consumed thrice a week. Above 10 per cent of the families consumed vegetables four times a week and occasional consumption was reported by 2.67 per cent of the families.

Occasional consumption of fruits was observed in 80 per cent of the families. Only 1.33 per cent of families consumed it daily. About 16 per cent consumed it once a week and 1.33 per cent consumed it twice a week.

Milk was consumed daily by 48.67 per cent of the families. About 12.67 per cent consumed it once in a week and 3.33 per cent consumed it twice in a week. Occasional consumption of milk and milk products was observed in 31.33 per cent of the families whereas 2.67 per cent of the families never used food item in their daily diet.

Occasional consumption of meat was observed in 73.33 per cent of the families. About 23.33 per cent of families consumed it once a week and 1.33 per cent consumed it twice a week. Consumption of meat was not observed in 2 per cent of the families.

Inclusion of fish in the daily diet was observed in 6.67 per cent of the families. The pattern of fish consumption was found to be weekly four times (7.33%), weekly thrice (24.67%), weekly twice (34.67%) and weekly once (23.33%) by the families. Occasional consumption of fish was reported by 2.67 per cent of the families and 0.67 per cent never used fish.

Regarding the consumption of eggs, 43.33 per cent of the families consumed it occasionally. About 43.33 per cent of the families consumed it once in a week, 6.67 per cent consumed twice in a week and 2.67 per cent of the families consumed eggs thrice in a week. Eggs were not consumed by 2.67 per cent of the families.

Frequency of purchase of different processed foods by the families was enquired and is presented in Table 18(a) and Table 18(b).

Table 18a. Frequency of purchase of instant/processed foods by the families

Food items	Frequency of purchase (Percentage of families)						
	Daily	W_4	W_3	W_2	W_1	Occ.	Never
1. Idli mix	-	-	-	-	-	8 (5.33)	142 (94.67)
2. Dosa mix	-	-	-	-	-	6 (4.00)	144 (96.00)
3. Corn flakes	-	-	-	-	-	-	150 (100)
4. Sambar mix	-	-	-	-	-	7 (4.67	143 (94.33)
5. Vermicelli	-	-	-	-	-	93 (62.00)	57 (38.00)
6. Noodles	-	-	-	-	-	9 (6.00)	141 (94.00)
7. Milkmaid	-	-	-	-	-	-	150 (100)
8. Milk powder	-	-	-	-	-	9 (6.00)	141 (94.00)
9. Ice cream mix	-	-	-	-	-	4 (2.67)	146 (97.33)
10. Paneer mix	-	-	-	-	-	-	150 (100)
11. Gulabjam mix	-	-	-	-	-	1 (0.67)	149 (99.33)
12. Jam	-	-	-	-	-	16 (10.67)	134 (89.33)
13. Cheese/butter	-	-	-	-	-	-	150 (100)
14. Jelly	-	-	-	-	-	-	150 (100)

Figures in parenthesis indicate percentage
Wi – 'i' times a week, i = 1, 2, 3, 4; Occ - Occasionally

As observed from Table 18a processed foods like corn flakes, milkmaid, paneer, cheese/butter and jelly were never purchased by the families. Majority of the families never purchased processed instant foods like idli mix (94.67%), dosa mix (96%), sambar mix (94.33%), noodles (94%), milk powder (94%), ice cream mix (97.33%), gulab jamum mix (99.33%) and jam (89.33%). Purchase of the

above items were found to be only occasionally by the rest of the families. Occasional purchase of vermicelli was observed by 62 per cent of the families.

Table 18b. Frequency of purchase of processed beverage items and fried foods by the families

Food items	Frequency of purchase (Percentage of families)						
	Daily	W_4	W_3	W_2	W_1	Occ.	Never
1. Squash	-	-	-	-	-	15 (10.00)	135 (90.00)
2. Cocoacola/pepsi/ others	-	-	-	-	-	21 (14.00)	129 (86.00)
3. Carbonated beverages	-	-	-	-	-	67 (44.67)	83 (55.33)
4. Bread	-	2 (1.33)	-	1 (0.67)	5 (33.33)	129 (86.00)	13 (8.67)
5. Cakes	-	-	-	-	-	85 (56.67)	65 (43.33)
6. Pasteries	-	-	-	-	-	6 (4.00)	144 (96.00)
7. Sauces	-	-	-	-	-	-	150 (100)
8. Ketch-ups	-	-	-	-	-	-	150 (100)
9. Pickles	-	-	-	-	-	59 (39.33)	91 (60.67)
10. Biscuits	-	-	-	-	-	138 (92.00)	12 (8.00)
11. chips	-	-	-	-	-	140 (93.33)	10 (6.67)
12. Mixtures	-	-	-	-	-	136 (90.67)	14 (9.33)
13. Samosa	-	-	-	-	-	92 (61.33)	58 (38.67)
14. Puffs	-	-	-	-	-	83 (55.33)	67 (44.67)
15. Cutlet	-	-	-	-	-	44 (29.33)	106 (70.67)
16. Pappad	11 (7.33)	6 (4.00)	3 (2.00)	1 (0.67)	56 (37.33)	69 (46.00)	4 (2.67)
17. Vattals	-	-	-	-	-	49 (32.67)	101 (67.33)

Figures in parenthesis indicate percentage
Wi – 'i' times a week, i = 1, 2, 3, 4; Occ - Occasionally

Table 18b reveals the purchase of different processed beverages, bakery items and fried foods by the families.

Majority of the families never purchased processed beverages, squash (90%), cocoacola/pepsi/other soft drinks (86%) and carbonated beverages (55.33%). Occasional purchase of these beverages was observed by the remaining families.

Eighty six per cent of families purchased bread occasionally and 3.33 per cent purchased it once in a week. Cakes were purchased occasionally by 56.67 per cent of the families and the remaining 43.33 per cent never purchased it.

Pasteries were not purchased by majority of the families (96%). About 39.99 per cent of the families purchased pickles occasionally while 60.67 per cent never purchased it.

Ninety two per cent of the families purchased biscuits and 93.33 per cent purchased chips occasionally. Mixtures, samosa and puffs were purchased occasionally by 90.67 per cent, 61.33 per cent and 55.33 per cent of the families respectively.

Cutlets and vattals were not purchased by majority of the families. Pappads were purchased occasionally by 46 per cent of the families. About 37.77 per cent purchased pappads once in a week and 7.33 per cent used it daily.

Table 19 deals with preparation of processed foods by the families.

Table 19. Preparation of processed foods by the families

Details	Number of families (n=150)
Preparation of processed foods	
Yes	114 (76.00)
No	36 (24.00)
Total	150
Pickles	106 (92.98)
Jam and pickle	4 (3.50)
Squash and pickle	1 (0.88)
Jam, squash and pickle	3 (2.63)

Figures in parenthesis indicate percentage

It is clear from Table 19 that majority of the families (76%) prepared processed food items in one or other way. About 92.98 per cent of families prepared pickles, 3.5 per cent of families prepared jams and pickles and 2.63 per cent of families prepared jams, squashes and pickles at home.

Purchase of prepared foods by the families were also studied and the results are presented in Table 20.

Table 20. Purchase of prepared foods by the families

Details	Number of families (n=150)
Families purchasing prepared foods	131 (87.33)
Families not purchasing prepared foods	19 (12.67)
Type of preference	
Vegetarian foods	58 (44.27)
Non-vegetarian foods	11 (8.40)
Both	62 (47.33)
Place of purchase	
Hotels and Bakery	97 (74.04)
Hotels	16 (12.21)
Bakery	18 (13.74)
Fast food centres	-
Frequency of purchase	
Daily	-
Once in a week	-
Twice in a week	-
Thrice in a week	-
Four times in a week	-
Occasionally	131 (100)

Figures in parenthesis indicate percentage

Among the families studied 87.33 per cent purchased prepared foods from outside. Among them 44.27 percent preferred vegetarian foods, 8.4 per cent preferred non-vegetarian foods and 47.33 per cent preferred both vegetarian and

non-vegetarian foods. Most of the families (74.04%) brought prepared foods from hotels and bakeries. Frequency of purchase of prepared foods was also studied and it was found that all the families purchased prepared foods occasionally.

Table 21 deals with foods prepared during special occasions by the families.

Table 21. Foods prepared by the families during special occasions

Details	Number of families (n=150)
Families celebrating special occasions	
Yes	150 (100)
No	-
Total	150

Occasions	Preparations	Number of families (n=150)
Birthday	Vegetarian	88 (58.67)
	Non-vegetarian	62 (41.33)
	Vegetarian/Non-vegetarian	-
Marriage	Vegetarian	88 (58.67)
	Non-vegetarian	59 (39.33)
	Vegetarian/Non-vegetarian	3 (2.00)
Death related functions	Vegetarian	94 (62.67)
	Non-vegetarian	28 (18.67)
	Vegetarian/Non-vegetarian	28 (18.67)
Festivals	Vegetarian	63 (42.00)
	Non-vegetarian	56 (37.33)
	Vegetarian/Non-vegetarian	31 (20.67)
Feast	Vegetarian	-
	Non-vegetarian	-
	Vegetarian/Non-vegetarian	150 (100)
Others	Vegetarian	-
	Non-vegetarian	-
	Vegetarian/Non-vegetarian	150 (100)

Figures in parenthesis indicate percentage

All the families prepared special foods for birthdays, marriages, death related functions etc. in their family.

For birthdays and marriages 58.67 per cent of families prepared vegetarian foods. In case of marriage 39.33 per cent prepared non-vegetarian foods and the remaining 2 per cent used to prepare either vegetarian or non-vegetarian foods. In 41.33 per cent of the families non-vegetarian foods were prepared for celebrating birthdays.

Most of the families (62.67%) prepared vegetarian foods during occasions in connection with the death of any of the family members or relatives. About 18.67 per cent of families prepared only non-vegetarian foods, while the remaining 18.67 per cent prepared either vegetarian or non-vegetarian foods during such occasions.

Forty two per cent of families prepared vegetarian foods for festivals. About 37.33 per cent of the families prepared non-vegetarian foods and 20.67 per cent prepared either vegetarian or non-vegetarian foods during such occasions. During feasts and other occasions, most of the families prepared either vegetarian or non-vegetarian foods.

The foods given during special conditions and illnesses were studied and the results are presented in Table 22.

During infancy various weaning foods were prepared in all the families. The major weaning foods given to infants included banana flour porridge, ragi porridge, sago porridge, arrowroot porridge, fruit juices, steamed banana etc.

Table 22. Details of foods given during special conditions and illness

Details	Number of families (n = 150)
Infancy	
Soft and bland diet	150 (100)
Pre-school age	
Same as adult diet	150 (100)
Pregnancy	
Usual foods	-
Special foods	150 (100)
Lactation	
Usual foods	-
Special foods	150 (100)
Old age	
Usual foods	86 (57.33)
Modified diet	64 (42.67)
Examination time	
Usual foods	150 (100)
Illness	
Modified diet	150 (100)

Figures in parenthesis indicate percentage

From the table it is clear that all the families gave adult food to pre-school children. Extra amount of foods and fruits, milk, egg, green leafy vegetables like drumstick leaves, amaranth etc. were consumed by all the families during pregnancy. During lactation apart from these extra foods certain traditional ayurvedic medicines were given for improvement of their health. About 57.33 per cent of families consumed a usual diet during old age, but 42.67 per cent modified their diet depending on their age related problems.

No special foods were prepared during illness but highly seasoned and deep fried food items were avoided in all the families during diseased conditions. Most of the families consumed 'kanji', 'pappad', pickles etc. during illness.

4.2.2 Food habits of the adolescent girls

Details of food habits of adolescent girls is shown in Table 23.

Table 23. Food habits of adolescent girls

Details	Number of girls (n =150
Food habit	
Vegetarian	10 (6.67)
Non-vegetarian	140 (93.33)
Total	150 (100)
Meal pattern	
One major meal	-
Two major meals	19 (12.67)
Three major meals	131 (87.33)
Total	150 (100)

Figures in parenthesis indicate percentage

It was found that 93.33 per cent of girls consumed non-vegetarian foods. Majority of the girls (87.33%) consumed three major meals a day while 12.67 per cent of girls consumed only two major meals.

Eating habits of adolescent girls are given in Table 24.

Table 24 reveals that 94 per cent of girls used to take their breakfast while 6 per cent girls never took their breakfast. About 99.33 per cent took their lunch daily. Packed lunch was taken to school by 91.95 per cent of the girls whereas 8.05 per cent of their girls had their lunch at home.

Table 24. Eating habits of adolescent girls

Details	Number of girls (n =150)
1. Habit of taking breakfast	
Yes	141 (94.00)
No	9 (6.00)
2. Habit of taking lunch	
Yes	149 (99.33)
No	1 (0.67)
a) Taking packed lunch to school	137 (91.95)
Taking luch from home	12 (8.05)
b) Items taken for lunch	
Rice	143 (95.97)
Rice or chapathi	1 (0.67)
Rice or breakfast items	5 (3.35)
3. Habit of taking snacks for tea	
Yes	132 (88.00)
No	18 (12.00)
a) Preference of snacks	
Home made	34 (22.67)
Purchased	8 (5.33)
Both	108 (72.00)
None	-
4. Habit of taking dinner	
Yes	150 (100)
No	-
5. Habit of taking snacks in between meals	
Yes	107 (71.33)
No	43 (28.67)

Figures in parenthesis indicate percentage

Eighty-eight per cent of adolescent girls took snacks for evening tea. Majority of the girls (72%) preferred both home made and purchased snacks.

About 22.67 per cent of the girls preferred only home made snacks and 5.33 per cent preferred only snacks purchased from outside.

All the adolescent girls used to take their dinner daily. Majority of adolescent girls (71.33%) were in the habit of taking snacks that too fried foods in between their major meals.

Details of television watching practices of adolescent girls are shown in Table 25.

Table 25. Television watching practices of adolescent girls

Details	Number of girls (n=150)
1. Habit of watching television	
Yes	139 (92.67)
NO	11 (7.33)
2. Time spend on watching television	
a) Daily	
<_30mt	106 (76.26)
>30 mt	33(23.74)
b) Holidays	
<_30 mt	14(16.67)
>30 mt	125 (83.33)
3. Eating something while watching televsion	
Yes	80 (57.55)
No	59 (42.45)

Figures in parenthesis indicate percentage; n = Number of families

This table reveals that a majority of adolescent girls (92.67%) had the habit of watching television programmes. About 76.26 per cent of adolescent girls watched television daily for not more than 30 minutes and 23.74 per cent of them

were in the habit of watching television for more than 30 minutes. During holidays majority of girls (83.33%) watched television for more than 30 minutes while the remaining 16.67 per cent of them watched television only for about 30 minutes even during holidays.

The table also revealed that 57.55 per cent of girls ate something while watching television. The type of foods eaten included chips, nuts, fruits, sweets etc.

Eating-outside-habits of adolescent girls were enquired and are presented in Table 26.

Table 26. Eating- outside- habits of adolescent girls

Details	Number of girls (n=150)
Eating food from outside	
Yes	125 (83.33)
No	25 (16.67)
Types of food preferred	
Vegetarian	28 (22.40)
Non-vegetarian	82 (65.60)
Both	15 (12.00)
Place of purchase	
Hotels	13 (20.40)
Bakery	34 (27.20)
Hotels and Bakery	78 (62.40)
Fast food centres	-
Frequency of eating from outside	
Occasionally	91 (72.80)
Monthly	30 (24.00)
Weekly	4 (3.20)
Daily	-

Figures in parenthesis indicate percentage

Eating-outside-habits of the girls revealed that 83.33 per cent of the girls preferred to eat from outside whereas 16.67 per cent of girls did not like this. Non-vegetarian foods were preferred by majority of the girls (65.6%) and 22.4 per cent of girls preferred vegetarian foods while eating from outside. Most of the girls (62.4%) with this habit preferred foods from hotels and bakeries.

Frequency of eating from outside was analysed and it was found that 72.8 per cent of girls ate occasionally, 24 per cent ate once in a month and 3.2 per cent ate once in a week from hotels or restaurants.

Foods preferred for eating from outside by the adolescent girls are shown in Table 27.

Table 27. Foods preferred for eating from outside

Items	Percentage of girls
Fruit juices	80.67
Milk shakes	29.33
Cutlets	63 .9
Samosa	60.00
Puffs	60.67
Chapathi	47.33
Meals	41.33
Paratha	64.67
Biriyani	18.00
Noodles	4.00
Friend rice	1.33
Chicken preparation	55
Fish preparation	60
Egg preparation	66.33

From the table it is clear that majority of girls (80.67%) preferred items like fruit juice. About 60 per cent of girls preferred items like samosa, puffs and paratha for eating from outside. More than 55 per cent of adolescent girls preferred non-vegetarian items, like chicken, fish and egg preparations. Only very few

adolescent girls preferred items like noodles and fried rice for eating outside their homes.

Regarding the involvement of girls in cooking in the family it was observed that 88 per cent were involved in family cooking while 12 per cent were not involved.

Majority of the girls (96.67%) asked their parents to buy certain particular foods for them and the foods suggested by the girls to purchase included chocolates (77.24%), biscuits (75.17%), ice cream (66.21%), 'paratha' (49.66%), cutlets (23.45%), samosa (32.26%), puffs (26.21%) etc. and the source of information about these foods for majority of the girls is from television advertisements, friends and shops.

Other eating habits of the adolescent girls were enquired and the results are furnished in Table 28.

Table 28. Other eating habits of adolescent girls

Details	Number of girls (n=150)
Consumption of raw foods	
Yes	146 (97.33)
No	4 (2.67)
Specific time schedule for having food	
Yes	17 (11.33)
No	133 (88.67)
Taking meals along with other family members	
Yes	24 (16)
No	126 (84)
Total	150 (100)

Figures in parenthesis indicate percentage

Majority of the girls (97.33%) were in the habit of consuming raw foods such as fruits and vegetables like tomato, carrots etc. Most of the girls (88.67%) were not having a specific time schedule for taking food. About 84 per cent of adolescent girls did not take their meals along with family members.

Weight consciousness among adolescent girls were enquired and the details regarding this are presented in Table 29.

Table 29. Weight consciousness of adolescent girls

Details	Number of girls (n=150)
Weight consciousness among adolescent girls	
Yes	46 (30.67)
No	104 (69.33)
Practices adopted for maintaining weight	
Cycling	3 (6.52)
Walking	8 (17.39)
Diet control	6 (13.04)
Skipping meals	5 (10.87)
Exercise	1 (2.17)
Diet control and walking	3 (6.52)
Diet control and exercise	1 (2.17)
Skipping meals and exercise	1 (2.17)
Skipping meals and walking	1 (2.17)
Skipping meals, walking and cycling	2 (4.35)
Diet control, exercise, walking and cyling	3 (6.52)
None	12 (26.09)

Figures in parenthesis indicate percentage

Table 29 reveals that only 30.67 per cent of the adolescent girls were conscious about their weight whereas majority of them (69.33%) were not concerned about their weights. About 17.39 per cent of adolescent girls were interested in walking as a means of maintaining body weight. About 13.04 per cent girls controlled their diet to maintain body weight and 10.87 per cent of girls skipped a meal to reduce body weight. Diet control and walking were reported by

6.52 per cent of girls as ideal means for maintaining body weight. About 26.09 per cent of girls were not engaged in any of the weight maintaining practices.

4.3 Nutritional status of adolescent girls

a) Anthropometric measurements

Height and weight

Anthropometric measurements such as body height and weight of the adolescent girls were taken and the mean values were compared with ICMR (1990) standards and the details are given in Table 30.

The above table revealed that mean height of girls in 13 years old was comparable with standard values. But their mean weight was found to be significantly low. Mean height and weight of girls of 14 and 15 years were significantly low when compared to ICMR standard values for that age group.

Weight for age

Based on the weight for age classification of Gomez *et al.* (1956) the adolescent girls were categorized into different grades of malnutrition and is shown in Table 31.

Table 31. Distribution of adolescent girls (13-15 yrs) based on weight for age (Gomez *et al.*, 1956)

Nutritional status	Weight for age ratio (%)	Girls (n=150)
Grade III – Malnutrition	≤ 60	3 (2.00)
Grade II – Malnutrition	60-75	35 (23.33)
Grade I – Malnutrition	75-90	69 (46.00)
Normal	>90	43 (28.67)
Total		150

Figures in parenthesis indicate percentage

Table 30. Mean height and weight of adolescent girls in comparison with ICMR standards (1990)

Criteria	13 years (n = 73)			14 years (n = 66)			15 years (n = 11)		
	Mean	Standard	't' value	Mean	Standard	't' value	Mean	Standard	't' value
Height (cm)	152.51	153.44	1.80^{NS}	152.35	155.04	4.33*	152.67	155.98	2.37*
Weight (kg)	39.04	44.54	5.91*	39.30	46.70	8.18*	38.27	48.75	6.64*

ICMR - Indian Council of Medical Research
* Significant at 5% level
NS – Not significant

It is clear from Table 31, that only 28.67 per cent of the adolescent girls were having normal weight for age. The prevalence of grade I malnutrition was found to be in 46 per cent and grade II malnutrition was observed in 23.33 per cent of girls. Grade III malnutrition was found to occur among 2 per cent of girls (Fig.1).

Height for age

Based on height for age classification of Waterlow (1972) adolescent girls were categorized into different grades of malnutrition and the details are presented in Table 32.

Table 32. Distribution of adolescent girls based on height for age (Waterlow, 1972)

Nutritional status	Height for age ratio (%)	Girls (n=150)
Severe malnutrition	≤ 85	-
Moderate malnutrition	85-90	4 (2.67)
Marginal malnutrition	90-95	24 (16.00)
Normal	>95	122 (81.33)
Total		150

Figures in parenthesis indicate percentage

As indicated in Table 32, 81.33 per cent of the adolescent girls were having normal height for age. Moderate and marginal malnutrition were observed in 2.67 per cent and 16 per cent respectively among girls (Fig.2).

Body Mass Index (BMI)

Based on BMI, adolescent girls were grouped into different grades of malnutrition and the details are furnished in Table 33.

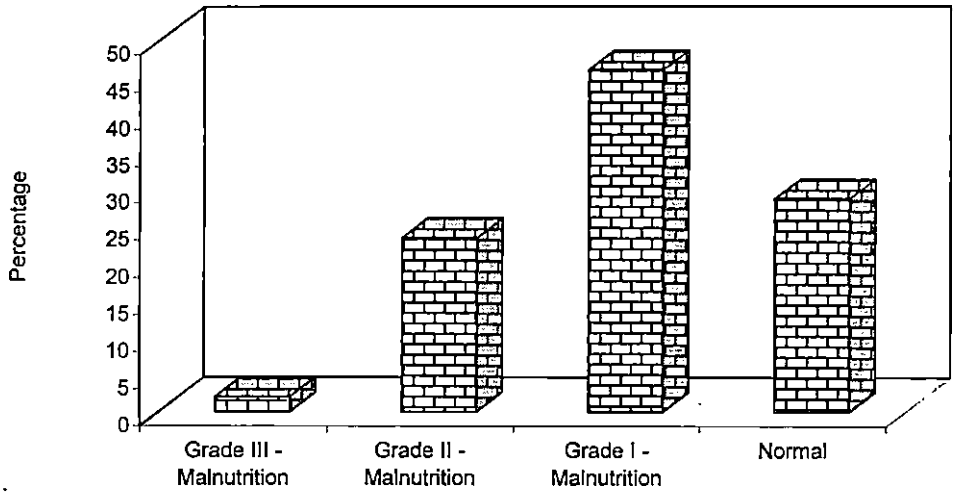

Fig. 1. Distribution of adolescent girls based on weight for age

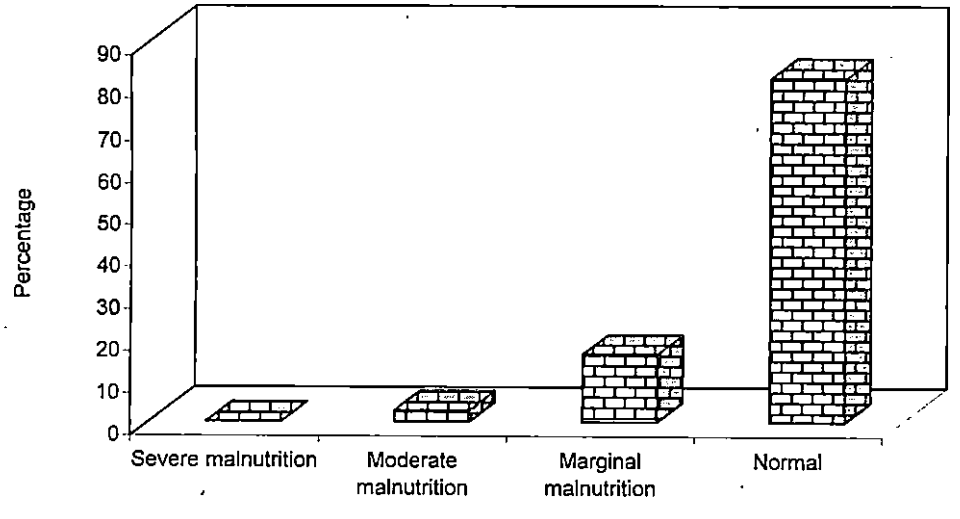

Fig. 2. Distribution of adolescent girls based on height for age

Table 33. Distribution of adolescent girls (13-15 years) based on Body Mass Index (James *et al.*, 1988)

BMI	Nutritional status	Girls (n=150)
<16.0	Chronic energy deficiency (CED) – Grade III	66 (44.0)
16.0-17.0	Chronic energy deficiency (CED) – Grade II	27 (18.0)
17.0-18.5	Chronic energy deficiency (CED) – Grade I	27 (18.0)
18.5-20.0	Low normal	13 (8.7)
20.0-25.0	Normal	15 (10.0)
25.0-30.0	Obese – Grade I	2 (1.3)
>30.0	Obese – Grade II	0 (0)
Total		150

Figures in parenthesis indicate percentage

As indicated in Table 33, only 10 per cent of adolescent girls were having normal nutritional status. Low but normal nutritional status was observed in 8.7 per cent of them and 18 per cent of girls each were having CED grade I and II. Forty four per cent of the girls were having CED grade III. About 1.3 per cent of the girls came under obese grade I (Fig.3).

b) Clinical examination

Clinical examination was conducted in a subsample of 30 adolescent girls and the results are presented in Table 34.

Table 34. Details of clinical examination of adolescent girls

Details	Girls (n=150)
Clinical symptoms	
Present	15 (50.00)
Absent	15 (50.00)
Total	30
Type of clinical symptoms	
a) Carries	4 (26.67)
b) Pigmented skin	1 (6.67)
c) Glossitis	1 (6.67)
d) Anaemia	9 (60.00)
Total	15

Figures in parenthesis indicate percentage

From the above table, it is evident that manifestations of clinical deficiency symptoms were observed among 50 per cent of adolescent girls.

Dental carries was observed among 26.67 per cent of the girls. Among 6.67 per cent of girls pigmentation of the skin was observed and glossitis was observed among 6.67 per cent. Majority of girls (60%) were found to have symptoms of anaemia.

c) Haemoglobin levels

Biochemical estimation of haemoglobin was done in a subsample of 30 girls and distribution of girls based on the prevalence of anaemia is presented in Table 35.

Table 35. Haemoglobin levels of adolescent girls

(Gopaldas and Seshadri, 1987)

Hb levels (g/dl)	Presumptive diagnosis	Number of Girls (n = 30)
<8	Deficient	-
8-10	Low	5 (16.67)
10-12	Low	11 (36.67)
>12	Acceptable	14 (46.67)

Figures in parenthesis indicate percentage

As revealed from the Table 46.67 per cent of the girls had acceptable Hb values. In 36.67 per cent of girls low Hb values were observed and suffered from moderate anemia. The remaining 16.67 per cent of them suffered from mild anemia, values ranging between 8-10 g/dl.

d) Food weighment survey

Actual food intake of adolescent girls was assessed by a one day food weighment among a subsample of 15 girls and the results are furnished in Table 36.

Table 36. Mean food intake of adolescent girls in comparison with RDA* (g/day)

Food item	RDA (g)	Actual intake (g)	't' value
Cereals	440	358 (81.4)	6.57*
Pulses	25	28 (112)	0.32 NS
Green leafy vegetables	125	10 (8.00)	21.52*
Other vegetables	75	27 (36.00)	4.63*
Roots and tubers	50	36 (72.00)	1.15 NS
Fruits	30	15 (50.00)	2.35*
Milk and milk products	250	67 (26.80)	17.42*
Fats and oils	60	36 (60.00)	25.37*
Meat, fish and egg	60	36 (60.00)	2.79*
Sugar/jaggery	40	39 (75.00)	4.80*

Figures in parenthesis indicate percentage of RDA
*RDA – Recommended Dietary Allowances for Indians (ICMR, 1989)
N – number of adolescent girls
* Significant at 5% level, NS – Not significant

From Table 36, it is clear that all food groups except pulses were consumed lower than the RDA by adolescent girls. Consumption of pulses was found to be 112 per cent of the RDA, and the difference was not statistically significant. Regarding roots and tubers 72 per cent of RDA was met and the difference was not statistically significant when compared to RDA. The pattern of consumption of cereals, green leafy vegetables, other vegetables, fruits, milk and milk products, fats and oils, meat, fish and egg and sugar and jaggery were 81.4 per cent, 8 per cent, 36 per cent, 50 per cent, 26.8 per cent, 60 per cent, 60 per cent and 75 per cent respectively of RDA. All these mean values were significantly low when compared with RDA (Fig.4).

Mean nutrient intake of the girls was computed using the food composition table and the results are furnished in Table 37.

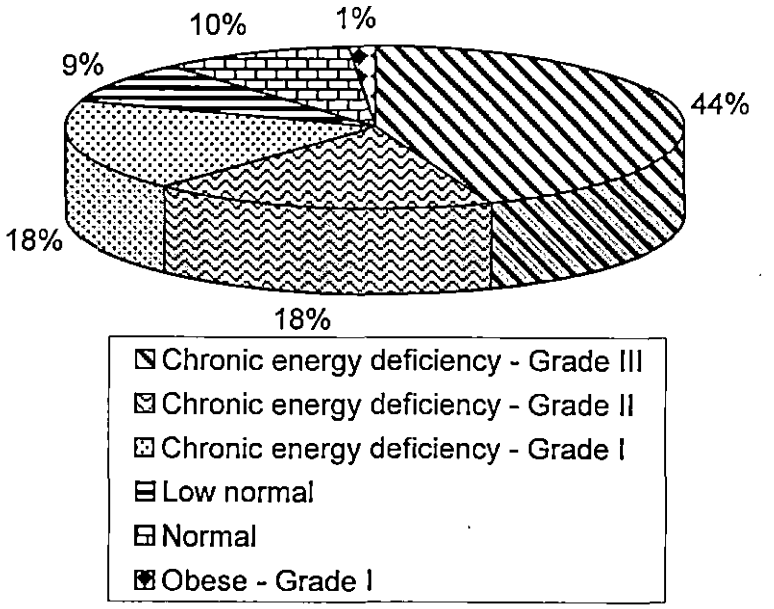

Fig. 3. Distribution of adolescent girls based on Body Mass Index

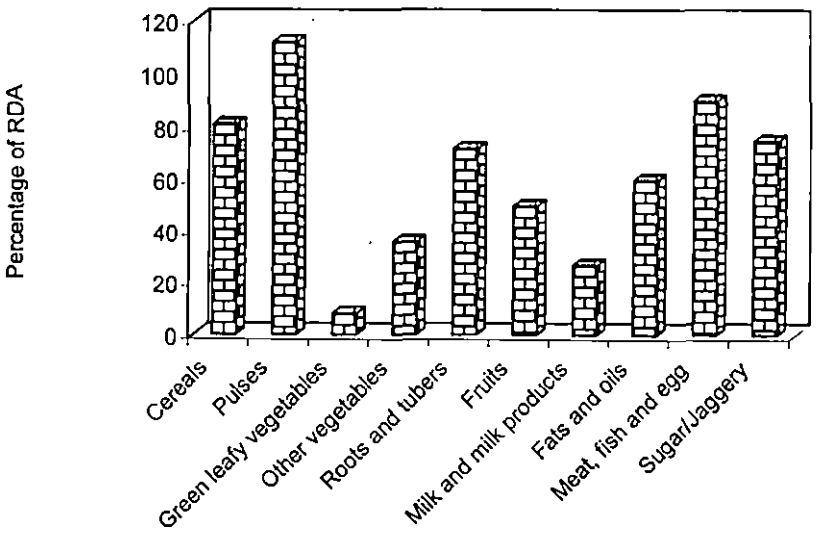

Fig. 4. Intake of food groups by adolescent girls as percentage of RDA

Table 37. Mean nutrient intake of adolescent girls in comparison with RDA

Nutrients	RDA	Actual intake	't' value
Energy (Kcal)	2060	2083 (101.1)	0.26 NS
Protein (g)	65	45 (69.2)	6.13*
Calcium (mg)	600	362 (60.3)	2.53*
Iron (mg)	28	23 (82.1)	8.81*
Vitamin A (µg)	1200	251 (21.0)	11.52*
Thiamine (mg)	1.0	0.9 (90.0)	6.12*
Riboflavin (mg)	1.2	0.7 (58.3)	7.80*
Niacin (mg)	14	13 (92.9)	3.07*
Vitamin C (mg)	40	29 (12.5)	13.25*

Figures in parenthesis indicate percentage of RDA
RDA – Recommended Dietary Allowances (Gopalan *et al*. 1989)
* Significant at 5% level, NS – Not significant

Table 37 reveals that among nutrients adequate level was met only for energy. The pattern of nutrient intake of protein, calcium and iron was 69.2 per cent, 60.3 per cent and 82.1 per cent of the RDA respectively.

The intake of vitamins like thiamine, vitamin A, riboflavin, niacin and vitamin C was significantly low when compared to RDA (Fig. 5).

Among nutrients only energy intake was found to be adequate. Hence the relation between energy intake and anthropometric indices like weight for age and height for age were analysed using two way frequency tables and is presented in Tables 38 and 39.

Table 38 presents the relation between energy intake and weight for age of adolescent girls.

As revealed from the table only 50 per cent of girls coming under normal (weight for age > 90%) had adequate energy intake.

As per the above table all the girls were having normal height for age and for 60 per cent of girls the energy intake was above 93 per cent of RDA.

Table 38. Energy intake and weight for age of adolescent girls

Energy (Kcal) / Weight for age	1648 1787	1788 1927	1928 2059	2060 2242	2243 3047	Total
< 60% (Grade III malnutrition)	0	0	0	0	0	0
60 – 75% (Grade II malnutrition)	1	0	0	0	2	3
75 - 90% (Grade I malnutrition)	0	0	1	1	0	2
>90% (Normal)	2	3	0	4	1	10
Total	3	3	0	5	3	15

Table 39. Energy intake and height for age of adolescent girls

Energy (Kcal) / Height for age	1648 1787	1788 1927	1928 2059	2060 2242	2243 3047	Total
< 85% (severe malnutrition)	0	0	0	0	0	0
85 – 90% (moderate malnutrition)	0	0	0	0	0	0
90 - 95% (marginal malnutrition)	0	0	0	0	0	0
>95% (Normal)	3	3	1	5	3	15
Total	3	3	1	5	3	15

The major deficiency symptom observed was anaemia (60%). In order to find the contribution of low intake of nutrients like protein and iron to anaemic symptoms, the data was analysed using two way frequency tables.

Table 40 presents the protein intake and deficiency symptoms in adolescent girls.

No relationship was observed between protein intake and deficiency symptoms in the present study.

Table 40. Protein intake and deficiency symptoms in adolescent girls

Deficiency symptoms Protein (g)	Absent 0.00 0.99	Present 1.00 1.99	Total
19 - 27	3	0	3
28 - 36	0	0	0
37 - 42	4	1	5
45 - 64	3	3	6
65 - 74	1	0	1
Total	11	4	15

Table 41 presents the iron intake and deficiency symptoms in adolescent girls.

Table 41. Iron intake and deficiency symptoms in adolescent girls

Deficiency symptoms Iron (mg)	Absent 0.00 0.99	Present 1.00 1.99	Total
18.1 – 20	1	2	3
20.1 – 22	3	0	3
22.1 – 25	5	2	7
25.1 – 27	2	0	2
Total	11	4	15

Iron intake was found to have no relation with the deficiency symptoms of anaemia.

Table 42 presents the data on protein and iron intake of girls compared with deficiency symptoms.

As revealed from the table no relation was observed between these variables.

Table 42. Deficiency symptoms - Protein and iron intake in adolescent girls

Protein (g) / Iron (mg)	19 - 27	28 - 36	37 - 42	45 - 64	65 - 74	Total
18.1 – 20	0	0	1 (Absent) 1 (Present)	1 (Present)	0	3
20.1 – 22	1 (Absent)	0	1 (Absent)	1 (Absent)	0	3
22.1 – 25	2 (Absent)	0	2 (Absent)	2 (Present) 1 (Absent)	1 (Absent)	8
25.1 – 27	0	0	0	1 (Absent)	0	1
Total	3	0	5	6	1	15

Figures in parenthesis indicates deficiency symptoms

To find the relation between haemoglobin values and nutrient intake like iron and protein, the data was analysed using two way frequency table and is presented in Table 43, 44 and 45.

Table 43. Iron intake and haemoglobin levels of adolescent girls

Hb level (g/dl) / Iron (mg)	<8 (Deficient)	8-10 (Low)	10-12 (Low)	>12 (Acceptable)	Total
18.1 – 20	0	2	1	0	3
20.1 – 22	0	0	0	3	3
22.1 – 25	0	1	4	2	7
25.1 – 27	0	0	1	1	2
Total	0	3	6	6	15

Table 44. Protein intake and haemoglobin levels of adolescent girls

Hb level (g/dl) / Protein (g)	<8 (Deficient)	8-10 (Low)	10-12 (Low)	>12 (Acceptable)	Total
19 - 27	0	0	2	1	3
28 - 36	0	0	0	0	0
37 - 42	0	1	2	2	5
45 - 64	0	2	1	3	6
65 - 74	0	0	1	0	1
Total	0	3	6	6	15

Table 45. Protein and iron intake and Haemoglobin levels of adolescent girls

Protein (g) / Iron (mg)	19 - 27	28 - 36	37 - 42	45 - 64	65 - 74	Total
18.1 – 20	0	0	1 (11.23) 1 (8.36)	1 (9.95)	0	3
20.1 – 22	1 (13.32)	0	1 (14.12)	1 (11.06)	0	3
22.1 – 25	1 (11.63) 1 (11.06)	0	1 (11.02) 1 (14.66)	1 (8.7) 1 (13.39) 1 (10.02)	0	7
25.1 – 27	0	0	0	1 (14.06)	1 (10.46)	2
Total	3	0	5	6	1	15

Figures in parenthesis indicates haemoglobin levels

From the above tables it was observed that there was no relation between protein and iron intake and haemoglobin levels.

4.4 Endurance capacity of adolescent girls

Endurance capacity of the girls was measured by Harvard's step test and the girls were grouped based on their endurance capacity. The results are presented in Table 46..

Table 46. Distribution of adolescent girls based on endurance capacity (Brouha, 1943)

Index	Physical condition	Number of girls (n=30)
<55	Poor physical condition	2 (6.67)
55-64	Low average	12 (40.00)
65-79	High average	16 (53.33)
80-89	Good	0 (0.0)
>90	Excellent	0 (0.0)

Figures in parenthesis indicate percentage

Table 46 reveals that about 6.67 per cent of adolescent girls were having poor physical condition as assessed by their endurance capacity. Forty per cent had

low average endurance capacity and the remaining 53.3 per cent had high average endurance capacity (Fig. 6).

The relationship between endurance capacity of the adolescent girls and their nutritional status as assessed by weight for age and height for age was analysed using two way frequency tables and is presented in Table 47 and 48.

Table 47. Endurance capacity and weight for age of adolescent girls

Endurance capacity Weight for age	<55 (Poor)	55 – 64 (Low average)	65 – 79 (High average)	80 – 89 (Good)	Total
<60% (Grade III malnutrition)	0	0	0	0	0
60 – 75% (Grade II malnutrition)	2	3	3	0	7
75 – 90% (Grade I malnutrition)	0	5	4	0	9
>90% (Normal)	0	4	10	0	14
Total	2	12	16	0	30

As revealed in the table no one had good endurance capacity. Low average endurance capacity was found to be more among girls with grade I and grade II malnutrition. High average endurance capacity was observed in more than 70 per cent of girls in the normal group.

Table 48. Endurance capacity and height for age of adolescent girls

Endurance capacity Height for age	<55 (Poor)	55 – 64 (Low average)	65 – 79 (High average)	80 – 89 (Good)	Total
<85% (Severe malnutrition)	0	0	0	0	0
85 – 90% (Moderate malnutrition)	0	0	0	0	0
90 – 95% (Marginal malnutrition)	2	0	0	0	2
>95% (Normal)	0	12	16	0	28
Total	2	12	16	0	30

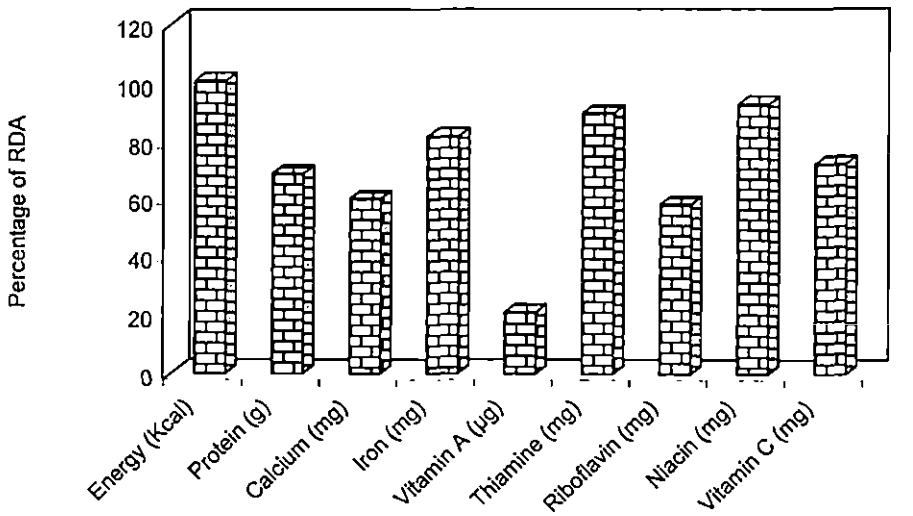

Fig. 5. Intake of nutrients by adolescent girls as percentage of RDA

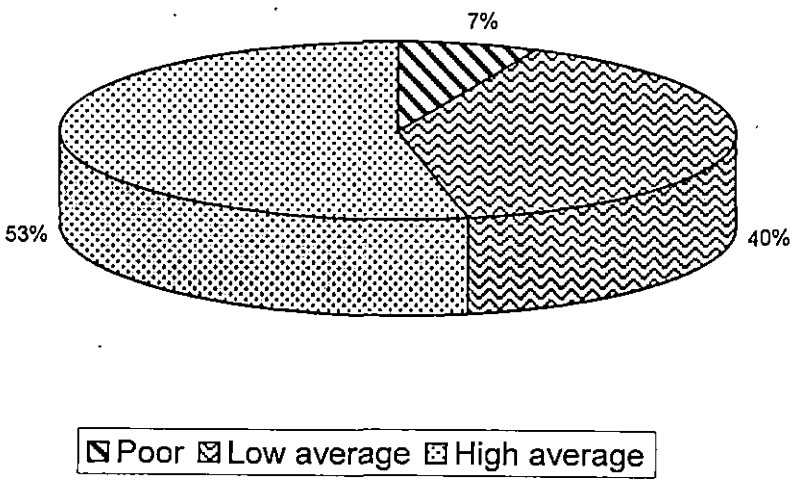

Fig. 6. Distribution of adolescent girls based on endurance capacity

Poor endurance capacity was observed among girls with marginal malnutrition. High average endurance capacity was found to be more among normal group girls.

Table 49. Endurance capacity and haemoglobin levels of adolescent girls.

Endurance capacity / Haemoglobin levels (g/dl)	<55 (Poor)	55 – 64 (Low average)	65 – 75 (High average)	Total
<8 (Deficient)	0	0	0	0
8 – 10 (Low)	0	3	0	3
10 – 12 (Low)	0	5	1	6
>12 (Acceptable)	0	0	6	6
Total	0	8	7	15

Endurance capacity and haemoglobin levels of adolescent girls revealed that girls with acceptable haemoglobin levels had high average endurance capacity. A linear relationship was observed between haemoglobin levels and endurance capacity.

Dependence of endurance capacity on haemoglobin was estimated by the regression $Y = 3.33 x + 26.11$ with a correlation of 0.85. The regression was significant at 1 per cent level (Fig. 7).

The relationship between endurance capacity and intake of various nutrients were analysed using two way frequency tables and is presented in the following tables.

Table 50 presents the endurance capacity and energy intake of adolescent girls.

Table 50. Endurance capacity and energy intake of adolescent girls

Endurance capacity / Energy (Kcal)	<55 (Poor)	55 – 64 (Low average)	65 – 79 (High average)	Total
1648 – 1787	0	2	1	3
1788 – 1927	0	1	2	3
1928 – 2059	0	1	0	1
2060 – 2242	0	2	3	5
2243 – 3047	0	2	1	3
Total	0	8	7	15

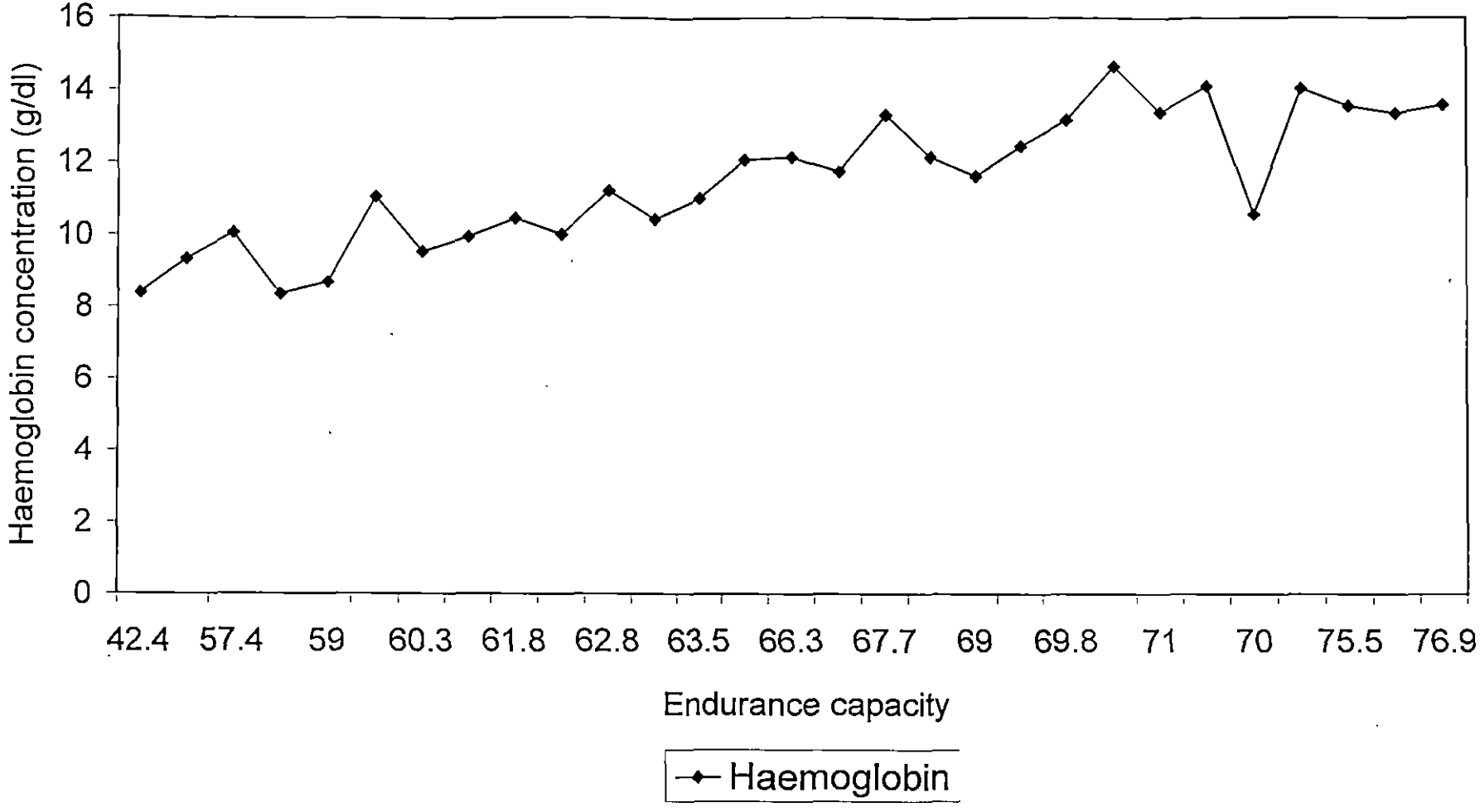

Fig. 7. Relation between haemoglobin and endurance capacity of adolescent girls

As revealed from the table for 57 per cent of the girls with high average endurance capacity the energy intake was found to be adequate.

Table 51. Endurance capacity and protein intake of adolescent girls

Endurance capacity / Protein (g)	<55 (Poor)	55 – 64 (Low average)	65 – 79 (High average)	Total
19 - 27	0	1	2	3
27 – 36	0	0	0	0
37 – 42	0	3	2	5
45 – 64	0	2	3	5
65 – 74	0	2	0	2
Total	0	8	7	15

Table 52. Endurance capacity and thiamine intake of adolescent girls

Endurance capacity / Thiamine (mg)	<55 (Poor)	55 – 64 (Low average)	65 – 79 (High average)	Total
0.60 - 0.69	0	1	2	3
0.79 - 0.89	0	4	5	9
0.99 - 1.09	0	3	0	3
Total	0	8	7	15

Table 53. Endurance capacity and riboflavin intake of adolescent girls

Endurance capacity / Riboflavin (mg)	<55 (Poor)	55 – 64 (Low average)	65 – 79 (High average)	Total
0.30 - 0.40	0	1	1	2
0.48 - 0.61	0	2	1	3
0.68 - 0.81	0	3	3	6
0.89 - 1.01	0	2	0	2
1.09 - 1.20	0	0	2	2
Total	0	8	7	15

Table 54. Endurance capacity and niacin intake of adolescent girls

Endurance capacity / Niacin (mg)	<55 (Poor)	55 – 64 (Low average)	65 – 79 (High average)	Total
10.20 - 11.99	0	1	2	3
12.95 - 13.13	0	0	2	2
12.95 - 13.13	0	2	0	2
13.14 - 13.51	0	2	0	2
13.71 - 14.00	0	3	3	6
Total	0	8	7	15

Table 55. Endurance capacity and iron intake of adolescent girls

Endurance capacity / Iron (mg)	<55 (Poor)	55 – 64 (Low average)	65 – 79 (High average)	Total
18.1 - 20	0	3	0	3
20.1 - 22	0	0	3	3
22.1 - 25	0	4	3	7
22.1 - 27	0	1	1	2
Total	0	8	7	15

As revealed from the above tables no relationships was observed between nutrients like protein, thiamine, riboflavin, niacin and iron with endurance capacity.

The relationship between endurance and energy, and energy related nutrients were analysed and is presented in Tables 56, 57, 58, 59 and 60.

Table 56. Endurance capacity - energy and protein intake of adolescent girls

Protein (g) / Energy (Kcal)	19 - 27	28 - 36	37 - 42	45 - 64	65 – 74	Total
1648 - 1787	1 (67.7)	0	1 (58.5) 1 (63.5)	0	0	3
1788 - 1927	1 (69.0)	0	1 (71) 1 (62.8)	0	0	3
1928 - 2059	0	0	0	1 (68.6)	0	1
2060 - 2242	1 (59.7)	0	1 (70.6)	1 (71) 1 (61.2) 1 (62.2)	0	5
2243 - 3047	0	0	0	1 (61.8) 1 (59)	1 (73.2)	3
Total	3	2	2	2	6	15

Figures in parenthesis indicate endurance capacity

Table 57. Endurance capacity - energy and thiamine intake of adolescent girls

Thiamine (mg) Energy (Kcal)	0.60 0.69	0.79 0.89	0.99 1.09	Total
1648 - 1787	0	1 (67.7) 1 (63.5)	1 (58.5) 0	3
1788 - 1927	1 (69.0) 0	1 (62.8) 1 (71.0)	0	3
1928 - 2059	0	1 (68.6) 0	0	1
2060 - 2242	1 (61.2) 1 (71.0)	1 (62.2) 1 (70.6)	1 (59.7) 0	5
2243 - 3047	0	1 (73.2) 1 (59.0)	1 (61.8) 0	3
Total	3	9	3	15

Figures in parenthesis indicate endurance capacity

Table 58. Endurance capacity – energy and riboflavin intake of adolescent girls

Riboflavin (mg) Energy (Kcal)	0.30 0.40	0.48 0.61	0.68 0.81	0.89 1.01	1.09 1.2	Total
1648 - 1787	0	1 (63.5)	0	1 (58.5)	1 (67.7)	3
1788 – 1927	1 (71)	1 (62.8)	0	0	1 (69)	3
1928 - 2059	0	0	1 (68.6)	0	0	1
2060 - 2242	1 (61.2)	1 (71)	1 (59.7) 1 (70.6) 1 (62.2)	0	0	5
2243 - 3047	0	0	1 (73.2) 1 (59)	1 (61.8)	0	3
Total	2	3	6	2	2	15

Figures in parenthesis indicate endurance capacity

Table 59. Endurance capacity - energy and niacin intake of adolescent girls

Niacin (mg) Energy (Kcal)	10.20 11.99	12.10 12.37	12.95 13.13	13.14 13.51	13.71 14.00	Total
1648 - 1787	1 (67.7) 1 (58.5)	0	1 (63.5)	0	0	3
1788 - 1927	1 (69.0)	1 (71.0)	0	1 (62.8)	0	3
1928 - 2059	0	0	0	0 0	1 (68.6)	1
2060 - 2242	0	1 (70.6)	1 (62.2)	1 (59.7)	1 (71) 1 (61.2)	5
2243 - 3047	0	0	1 (59)	0	1 (61.8)	3
Total	3	2	2	2	6	15

Figures in parenthesis indicate endurance capacity

Table 60. Endurance capacity – energy and iron intake of adolescent girls

Iron (mg) Energy (Kcal)	18.1 20	20.1 22	22.1 25	25.1 27	Total
1648 - 1787	1 (58.5)	1 (67.7)	1 (63.5)	0	3
1788 - 1927	1 (62.8)	1 (71)	1 (69)	0	3
1928 - 2059	0	1 (68.6)	0	0	1
2060 - 2242	1 (61.2)	0	1 (71) 1 (62.2) 1 (70.6) 1 (59.7)	0	5
2243 - 3047	0	0	1 (59)	1 (61.8) 1 (73.2)	3
Total	3	3	7	2	15

Figures in parenthesis indicate endurance capacity

No relationship was observed between endurance capacity and other energy related nutrients.

The relationship between endurance capacity, food intake and nutritional status as assessed by anthropometric indices like weight for age and height for age are presented in Table 61 and 62.

Table 61. Endurance capacity – Weight for age and energy intake of adolescent girls

Energy (Kcal) Weight for age	1648 1787	1788 1927	1928 2059	2060 2242	2243 3047	Total
< 60% (Grade III malnutrition)	0	0	0	0	0	0
60 – 75% (Grade II malnutrition)	1 (58.5)	0	0	0	1 (61.8) 1 (59.0)	3
75 - 90% (Grade I malnutrition)	0	0	0	1 (68.6) 1 (59.7)	0	2
>90% (Normal)	1 (67.7) 1 (63.5)	1 (69.0) 1 (62.8) 1 (71.0)	1 (70.6)	1 (71.0) 1 (61.2) 1 (62.2)	1 (73.2)	10
Total	3	3	1	3	3	15

Figures in parenthesis indicate endurance capacity

As revealed from the table high average endurance capacity was observed among girls coming under normal group (weight for age) with adequate energy intake.

Table 62. Endurance capacity - Height for age and energy intake of adolescent girls

Energy (Kcal) Height for age	1648 1787	1788 1927	1928 2059	2060 2242	2243 3047	Total
< 85%	0	0	0	0	0	0
85 – 90%	0	0	0	0	0	0
90 - 95%	0	0	0	0	0	0
>95%	1 (58.5) 1 (63.5) 1 (67.7)	1 (62.8) 1 (69.0) 1 (71.0)	1 (68.6)	1 (70.6) 1 (71.0) 1 (61.2) 1 (62.2) 1 (59.7)	1 (61.8) 1 (73.2) 1 (59.0)	15
Total	3	3	1	5	3	15

Figures in parenthesis indicate endurance capacity

No relationship was observed between endurance capacity-height for age and energy intake of adolescent girls.

The relation of endurance capacity with other factors like walking distance of the girls to schools and participation of girls in sports and games were also analysed and is presented in Tables 63, 64 and 65.

Table 63. Endurance capacity and walking distance of adolescent girls

Endurance capacity / Walking distance	<55 (Poor)	55 – 64 (Low average)	65 – 79 (High average)	Total
< ½ km	2	10	10	22
½ - 1 km	0	2	6	8
Total	2	12	16	30

Endurance capacity / Walking distance	39.65 59.64	59.65 69.64	69.65 79.64	Total
< ½ km	5	13	4	22
½ - 1 km	0	3	5	8
Total	5	16	9	30

Table value $\chi^2 = 5.991$ Calculated value $\chi^2 = 6.021$

Endurance capacity was found to be related with the walking habits of the adolescent girls. Among girls who walked upto 1 km daily, 75 per cent were having high average endurance capacity. Chi-square analysis revealed that there exists an association between these two variables.

Endurance capacity and participation in sports and games of adolescent girls are presented in Table 64.

Table 64.Endurance capacity and participation in sports and games of adolescent girls

Endurance capacity / Participation in sports and games	<55 (Poor)	55 – 64 (Low average)	65 – 79 (High average)	Total
No	2	12	11	25
Yes	0	0	5	5
Total	2	12	16	30

As detailed in the table all the girls who participated in sports and games had high average endurance capacity.

Table 65. Endurance capacity - walking distance and participation in sports and games of adolescent girls.

Participation in sports and games Walking distance	Yes	No	Total
< ½ km	1 (71)	21	22
½ - 1 km	1 (70.6) 1 (69.4) 1 (75.9) 1 (70)	4	8
Total	5	25	30

Figures in parenthesis indicates endurance capacity

Adolescent girls who walked upto 1 km daily and participated in sports and games showed high average endurance capacity. High average endurance was also observed in girls who participated in sports and games but with walking habits of less than ½ km a day.

Discussion

5. DISCUSSION

5.1 Socio-economic background of the families

The sample selected for the study consisted of 150 adolescent girls of the age group of 13-15 years.

Socio-economic details of the families are important factors having great impact on the nutritional status of school children (Saxena, 1986; Vijayalakshmi and Rao, 1988 and Ghosh, 1997).

In the present study majority of the families were Hindus (58.67%) followed by Christians (37.33%) and Muslims (4%). Among Hindus, majority (69.33%) belonged to other backward communities and 22.67 per cent belonged to scheduled caste and 8 per cent belonged to forward community.

Regarding the type of family system, the present study indicated that majority of the families (67.33%) followed nuclear family system. This reveals the recent social trend where there is fading of joint family system. This change is brought in by the social processes such as urbanization which has ushered in the spread of nuclear family system. Paul (1993), Jose (1998), Devi (2000) and Paul (2001) in their Kerala studies revealed that most of the families in Kerala followed nuclear family system.

The present study also revealed that more than half of the families had two adult members with two children. This finding is in line with the observations made by National Nutrition Monitoring Bureau (NNMB, 1984) in Kerala which reported that, small family norm was getting high practice even among low income

groups. Studies conducted by Cherian (1992), Jayanthakumari (1993), Shyna (1996), Udaya (1996) and Padikkal (2000) also revealed the same family pattern in Kerala with limited number of children.

A positive association between parental literacy and nutritional status was reported by Devadas (1994). The present study revealed that majority of the parents had high school education and none of them were illiterate. The female population had better educational level, which is very important, since the level of education of mothers, according to UNICEF (1991), affected the nutritional status of children.

Occupational status of parents revealed that 76.67 per cent of the mothers were unemployed. Forty per cent of fathers were working as labourers and 14.67 per cent were having temporary or permanent jobs.

The monthly income of roughly half the families was below Rs.2000/- and in 38.7 per cent of the families monthly income was between Rs.2001 and 4000. This is in line with the observations of Karuna (1993), Verma (1996) and Devi (2000) who had reported that the mean monthly income of the casual labourer families ranged from Rs.1000/- to Rs.3000/- in Kerala.

Monthly expenditure pattern showed that majority of the families spent 30 to 60 per cent of their income on food. About 22.67 per cent of the families spent more than 60 per cent of their income for food. The expenditure pattern of the families with respect to food is in line with the study conducted by Rai and Sarup (1995) who found that in Kerala 62.15 per cent of the total income was spent for food by the rural families. Similar findings were reported by Usha *et al.* (1990)

in Thiruvananthapuram District and Udaya (1996), Mathen (1998) and Devi (2000) in Thrissur District. The present study indicated that majority of the families spent less than 10 per cent of their income on clothing, transportation, education, entertainment, health, personal expenses, 'kuries', fuels etc. Similar results were observed by Augustine (1993) and Karuna (1993) in their studies in Thiruvananthapuram District and by Udaya (1996), Mathen (1998) and Devi (2000) in their studies in Thrissur District.

No single indicator could be able to capture the socio-economic status unbiasely. The under reporting of income could be counter balanced to some extent by house ownership. Further the housing condition would be a visible indicator of the socio-economic status of the households and also would reflect the physical amenities. In the present study majority of the families were living in their own houses. More than 50 per cent of the families had 3 to 5 rooms with tiled roofs. Majority of the houses were built with brick walls, had concrete flooring and had separate kitchen.

Source of drinking water and the type of sanitary facilities were deemed most important in terms of the incidence of infectious diseases, which are commonly prevalent in poorer societies. Here majority of the households (61.3%) were found to be dependent on their own wells for their drinking water. Lavatory facilities were present in almost all the families. More than 80 per cent of families had good drainage system and electricity facilities. Radio and television served as the source of recreation and information for majority of the families. Majority of the families watched television from their neighbouring households. Only 32 per

cent of families were found to possess labour saving devices such as mixies and pressure cookers.

Analysis of the pattern of cooking fuel brought an overwhelming predominance of the traditional wood burning system in rural Kerala.

5.2 Details regarding the selected adolescent girls

Majority of the adolescent girls were between thirteen and fourteen years of age. Sichieri *et al.* (1993) stated that birth weight of children is significantly correlated to the nutritional status. More than 80 per cent of the girls had normal birth weight. Majority of the selected adolescent girls belonged to 1st or 2nd birth order. Earlier studies from India have indicated that nutritional status during early adolescence has a great influence on the adolescent growth spurt and age at menarche. Rau *et al.* (1984) observed the mean age at menarche among rural adolescent girls in Kerala as 14.64. In the present study 40 per cent of girls attained menarche at the age of 13 and 21.33 per cent at the age of 14.Parveen and Beegum (2001) reported the mean menarcheal age of adolescent girls as 12.5±1.0 years in low income groups. She has also noted a trend towards decrease in the age at menarche over the last 2 to 3 decades in all the segment of the population irrespective of their rural urban residence or social class. This can be attributed to the changes in the food habits of the population over the past three decades.

Majority of the families utilized the services of government hospital and they resorted to allopathic medicines for treatment. Ninety per cent of adolescent girls had fever, while majority of the girls had not suffered from any major illnesses.

All the adolescent girls were involved in one or other type of household chores like washing clothes, utensils, sweeping the floor, cooking, gardening and care of younger siblings. All the girls had provision for physical education in school. Majority of the girls did not take part in sports and game activities, competitions and entertainment. More than half of the girls (58.67%) walked to their school while the rest depended on bus to go to school.

5.3 Food consumption pattern of the families

All the families surveyed were non-vegetarians and majority of the families (75.33%) planned their meal in advance and most of them (87.33%) followed a three major meal pattern consisting of breakfast, lunch and dinner. Similar meal patterns were observed by Ranganathan (1996), Udaya (1996), Devi (2000) and Paul (2001) in their Kerala studies.

In majority of the families 30 to 60 per cent of their food expenditure was on cereals. With regard to the purchase of pulses, other vegetables, green leafy vegetables, roots and tubers, meat and chicken, fish, egg, fruits, milk and milk products majority of them spent less than 20 per cent of the food expenditure.

Most of the families (90%) had the habit of drinking tea early in the morning. Rice in the form of 'choru' was served during breakfast, lunch and dinner. For breakfast 79 per cent of the families prepared vegetarian side dishes with roots and tubers, vegetables and dhal. For lunch 24 per cent of the families prepared fish and egg. Rice or chappathi were served for dinner for which side dishes were prepared with dhal, vegetables, roots and tubers or fish.

Daily consumption of pulses was found only in 7.33 per cent of the families. Eventhough, all the families was habitual non-vegetarians their consumption of non-vegetarian foods was not satisfactory which may be due to their high cost. In most of the families frequency of consumption of fish was found to be weekly twice or thrice. Among vegetables frequency of consumption of green leafy vegetables was very poor. In 71.33 per cent of families green leafy vegetables was consumed only occasionally. Other vegetables were consumed weekly thrice by 44 per cent of the families. But most of the families (44.67%) consumed roots and tubers weekly twice. Frequency of consumption of fruits was found to be occasional in most of the families (80%).

Daily consumption of milk and milk products was observed in 48.67 per cent of the families, mostly because of the daily consumption of tea that contains milk. Among other non-vegetarian foods eggs were consumed frequently when compared to meat. About 73.33 per cent of families consumed meat only occasionally whereas 43.33 per cent of the families consumed egg once in a week.

In this study it was found that the use of convenient foods such as ready to cook food mixes was only occasional by the families. Occasional purchase of these foods by majority of the families included items like vermicelli, cakes, biscuits, chips, mixtures, samosa, puffs and pappads.

Occasional purchase of prepared food items was observed in majority of the families. Most of the families (74.04%) purchased prepared foods from hotels and bakery.

All the families prepared foods during special occasions like birthdays, marriages, death related functions, festivals and feast. The food items prepared for various functions were different depending on the religion, caste, tradition, type and income.

All the families prepared foods during special conditions like infancy, pregnancy and lactation. This may be due to the increased awareness of the need for additional nutrients during these conditions. Most of the families modified their diet during illness. 'Kanji', 'pappad', pickle etc. were most widely consumed during diseased conditions. Highly seasoned and deep fried food items were avoided by most of the families during diseased conditions.

5.4 Food habits of adolescent girls

Majority of the girls (99.33%) consumed non-vegetarian foods and 87.33 per cent of girls consumed three major meals a day. Most of them (94%) were found to take their breakfast regularly. About 95.97 per cent of girls had rice for lunch and 3.35 per cent of them had rice or breakfast items for lunch. Similar results were reported by Paul (2001) in her Kerala studies. All adolescent girls used to take their dinner daily and majority of the girls (71.33%) were in the habit of taking snacks that too fried items in between their major meals.

Watching television daily was observed in majority of the girls (92.67%). Paul (1993) and Paul (2001) also observed the same leisure time activity among adolescent girls. Though television was present only in 29.33 per cent of families, most of the girls watched television from their neighbouring houses.

More than half of the girls expressed their likeness to eat something like chips, nuts, sweets etc. while they watched television.

Occasional eating of foods from outside was present among 72.8 per cent of adolescent girls, 24 per cent of them ate once in a month and 3.2 per cent ate once in a week from hotels and restaurant.

About 88 per cent of adolescent girls were involved cooking in the family. Majority of the girls asked their parent to buy particular foods which included chocolates, biscuits, ice creams, 'parathas' etc. The source of information about these foods for majority of the girls is from television advertisements, friends and shops.

Majority of the girls were not concerned about their weights and 17.39 per cent of adolescent girls were interested in walking as a means of maintaining body weight.

5.5 Nutritional status of adolescent girls

5.5.1 Anthropometric measurements

Mean body weight and height of adolescent girls were significantly low compared to Indian standard values as given by ICMR (1990) except for the mean height of girls of 13 years which was comparable with the standard values. Paul (1993), Suman (2000) and Paul (2001) also reported deficit in body height and weight among adolescents in Kerala. But studies of Nagi *et al.* (1995) reported normal body weight and height among adolescents in Ludhiana city.

Distribution of adolescent girls based on different grades of malnutrition as suggested by Gomez *et al.* (1956) revealed that majority of adolescent girls had grade I (46%) and grade II (23.33%) malnutrition. Only 28.67 per cent of adolescent girls had normal weight for age. This finding is in tune with Paul (1993), who indicated that the weight for age of adolescent boys and girls were below Indian standards. Chaturvedi *et al.* (1996) also reported different grades of malnutrition among adolescent girls of Rajasthan. This is in contradictory to the findings of Paul (2001) who reported that 60 per cent of adolescent girls were found to have normal weight for age.

Height is an indicator of long term nutritional status. Distribution of adolescent girls based on height for age as suggested by Waterlow (1972) revealed that majority of the girls (81.33%) had normal height for age.

Body Mass Index (BMI) indicates the nutritional status and it has good correlation with fatness (Rao and Vijayaraghavan, 1996). Body Mass Index of adolescent girls revealed high prevalence of chronic energy deficiency of grade III (44%) and 18 per cent of girls were having chronic energy deficiency of grade I and II each. A high prevalence of chronic energy deficiency of grade III was reported by Chaturvedi *et al.* (1996) among adolescent girls at the age group of 10-15 years in Rajasthan. On the contrary Rao *et al.* (1993) revealed that female children during 11-15 years are with higher weight/height^2 due to menarcheal age with better growth observed in females during this period.

5.5.2 Clinical manifestations of deficiency symptoms

Clinical examination is the most important part of nutritional assessment as direct information on signs and symptoms of dietary deficiencies prevalent are

obtained (Swaminathan, 1986). The present study revealed that 50 per cent of adolescent girls manifested clinical symptoms like dental carries (26.67%), pigmented skin (6.67%), glossitis (6.67%) and anaemia (60%). High incidence of dental carries was reported from Kerala by Paul (1993). Suman (2000) reported a high prevalence of dental caries and anaemia among adolescents in Kerala in the age group of 13 to 15 years. The author also reported a reduction in the number of adolescents with anaemia after a supplementation study with amaranth.

5.5.3 Haemoglobin levels

In the present study more than 50 per cent of adolescent girls had low haemoglobin levels. Same observation was reported by Sumati and Rajagopal (1990) that more than 50 per cent of school girls in India have haemoglobin levels less than 10.8 g/100 ml. Vasanthi *et al.* (1994) also reported that 25 to 50 per cent girls become anaemic by the time they reach menarche. In the present study about 46 per cent of adolescent girls had acceptable haemoglobin levels. Nagi *et al.* (1995) reported that only 23 per cent of adolescent girls of the age group 13 to 15 years in Ludhiana had acceptable haemoglobin levels.

5.5.4 Actual food and nutrient intake

The nutritional problem of developing countries are due to the fact that majority of the population subsist on an inadequate diet in terms of quantity and quality (Gopalan, 1991). Hence determination of food and nutrient intake is of utmost importance.

One day food weighment survey pointed out that the intake of cereals, green leafy vegetables, other vegetables, fruits, milk and milk products, fats and

oils, meat, fish and egg and sugar and jaggery were lower than the RDA. Similar to the findings of this study, Sarojini and Vijayalakshmi (1989), Lalmas *et al.* (1996) in Spain and Suman (2000) in Thrissur District reported inadequate intake of cereals, milk and milk products and sugar among adolescents. But Sarupriya and Mathew (1988) reported higher intake of cereals among adolescents in Rajasthan .Higher intake of cereals, fruits, fats and oils, sugar and jaggery were reported among adolescents in Thrissur district of Kerala by Paul (2001). Intake of pulses among adolescent girls was higher than the RDA. This is line with the observations of Suman (2000) and Paul (2001) in their studies among adolescents in Kerala.

The nutrient intake showed that only energy intake met the RDA. Suman (2000) and Paul (2001) reported that the energy intake of adolescent girls in Thrissur district of Kerala was higher than the RDA. The intake of all other nutrients was significantly low compared to RDA. This is in tune with the observations of Nagi *et al.* (1995) in her studies in school girls (13 to 15 years) of Ludhiana which revealed that the mean daily intake of protein, iron, calcium, vitamin A and vitamin C was inadequate compared to ICMR recommendations. Teenagers often eliminated leafy vegetables and they lack nutrients which are important for their growth and development. Desai (1996) also observed lower consumption of leafy vegetables among adolescents and resulted in low haemoglobin level.

Among nutrients only energy intake was found to be adequate. The increase in the intake of calories was associated with maximum increase in weight for age and height for age. A similar observation was reported by Rao (1996) in a

study among adolescence in Pune. She found that all the nutritional intake of adolescents were lower when compared to RDA but its relationship with growth was evident only with energy intake and a consistent increase in calorie intake was associated with maximum increase in weight and height in 14-16 year group. In the present study as revealed from their weight for age their current nutritional intakes could be low and are not meeting the increased requirements during adolescence. All the girls were having normal height for age which indicated no chronic energy deficiency.

A major deficiency symptom as observed by clinical examination was anaemia (60%). Iron intake was also found to be significantly low compared to RDA (82.1%). But the association between the intake of nutrients like protein and iron revealed that there was no relation between these variable in the present study. One of the reason for this may be due to the small sample size (15) for weighment survey and the two way frequency table was with this 15 samples.

As analysed by 2 way frequency tables there observed no relation between the haemoglobin levels and intakes of nutrients like iron and protein. This may be due to the small sample size for weighment survey.

5.6 Endurance capacity of adolescent girls

Endurance capacity of adolescent girls were measured using Harvard step test.

The results revealed that none of the adolescent girls had good or excellent physical condition. Suman (2000) reported from her study among adolescents in Thrissur district that no adolescents had excellent and good physical

condition before and after a supplementation study. About 6.67 per cent of adolescent girls in the present study had poor physical condition. Forty per cent had low average endurance capacity and the remaining 53.33 per cent had high average endurance capacity.

Two way frequency analysis revealed that there was a consistant increase in the endurance capacity of the girls as their nutritional status (as assessed by weight for age and height for age) improved. An association between small body size and impaired work productivity has been shown by Satynarayana *et al.* (1980). Work capacity is related to maximal aerobic capacity (Vo_2 max) and this is directly related to body size. He also pointed out that for the same work out put lighter subjects will have a higher heart rate and this may be considered indicative of reduced cardiac reserve and therefore a handicap for malnourished children.

Endurance capacity with haemoglobin levels when analysed, a linear relationship was observed between these variables. Girls with acceptable haemoglobin levels showed high average endurance capacity.

Bakalion *et al.* (1994) found that physical performance of school girls (11-14 years) with anaemia was low when compared to girls with normal haemoglobin. The results thus revealed that anaemia due to low haemoglobin concentration was found to be associated with decreased endurance capacity. Similar findings were reported by Seshadri (1988), Augustine (1993), Ash and Nelson (1998), Rajkumar and Premakumari (2000). This is because anaemic

subjects have to use higher heart rates for the same level of work compared to normal subjects and thus have poor endurance capacity.

In the present study 53.34 per cent of adolescent girls had low haemoglobin levels and were found to be anaemic. Low levels of circulating haemoglobin due to iron deficiency anaemia lead to reduced oxygen carrying capacity of the blood and reduces endurance capacity.

On analysis of endurance capacity and nutrient intake using two way frequency tables, relationship was observed between endurance capacity and energy intake. More girls with high average endurance capacity (57%) showed adequate energy intake. This high average endurance capacity among girls with sufficient energy intake may be due to their better nutritional status as revealed in their weight for age. Shetty (1988) also observed reduced physical work capacity among individuals with energy deficiency. Nutritional status with regard to minerals and vitamins can also affect the work output (Rao, 1996). B complex vitamins like thiamine, riboflavin and niacin take part in energy metabolism and their deficiency adversely affect energy metabolism and hence endurance capacity. The intake of B complex vitamins were found to be very low. Even though all other nutrients contribute to endurance capacity no relationship was observed between these variables in the present study. This may be due to the small sample size (15 samples) selected for the food weighment survey.

More girls coming under normal group (weight for age) with adequate energy intake had high average endurance capacity. No relationship was observed between endurance capacity – height for age and energy intake. When nutritional

status as assessed by weight for age and height for age compared to endurance capacity normal group girls showed more high average endurance capacity, but when energy intake was also considered there observed no relation for height for age. This may be due to the limitation of a small sample size for weighment survey.

A positive association was observed between endurance capacity and walking habits of the adolescent girls. Seventy five per cent of the girls having high average endurance capacity was found to walk up to 1 km/day.

A linear relationship was observed between endurance capacity and participation in sports and games by the girls. A high average endurance capacity was observed among girls with more walking distance and participation in sports and game activities. Even in girls where habitual walking was not observed participation in sports and games, contributed to high average endurance capacity. Satyanarayana *et al.* (1989) has reported that variations in physical work capacity could be attributed to differences in body weight and their levels of habitual physical activity.

In the present study, the adolescent girls was found to be in different grades of current malnutrition as revealed by their weight for age. Only 28.67 per cent were found to be having normal weight for their age. As revealed from their height for age, on 81.33 per cent of the girls were normal indicating no chronic malnutrition.

Sixty per cent of the girls were found to be anaemic. All the nutrients except energy intake was below the RDA. More girls belonging to normal group

had high energy intake, which was also reflected in their endurance capacity. Weight for age and energy intake was found to have relation with endurance as reported by Shetty (1988). A linear relation was observed between haemoglobin levels and endurance capacity. Another factor which found to influence the endurance capacity was their habitual physical activities like walking and participation in sports and games.

The prevalence of current malnutrition was found to be more among adolescent girls indicated by the weight for age. Since body weight is an important factor contributing to the physical work capacity, high average endurance capacity was observed. Other contributing factors observed for low endurance capacity was their low haemoglobin levels and low nutrient intakes. In spite of their low nutritional status and nutrient intake, their habitual physical activities have a positive effect on their endurance capacity.

The delayed adolescent growth could be due to low current nutritional intakes to meet the increased requirements of the adolescents. Hence nutrition education and short term appropriately planned nutritional interventions can be beneficial for improving adolescent growth and also encouraging in the participation of sports and games will improve their endurance capacity.

Summary

6. SUMMARY

The present study entitled 'Nutritional profile and endurance capacity of adolescent girls' was conducted among 150 school going adolescent girls of 13 to 15 years of age.

Information regarding socio-economic conditions of the families indicated that majority of the families were Hindus and belonged to backward communities. Nuclear family system with upto four member in the family was found in most of the families. Majority of the parents were educated and had satisfactory housing conditions and living facilities.

Majority of the fathers were labourers or with temporary jobs, business etc. and earned Rs.1000 to 4000 per month. More than 70 per cent of mothers were unemployed. A greater part of monthly income was spent on food by most of the families.

Among the selected adolescent girls, most of them had normal birth weight, belonged to 1st or 2nd birth order and more than 50 per cent attained menarche between 12 to 13 years of age. Morbidity pattern revealed the incidence of fever and no other serious illnesses. All the adolescent girls were involved in one or other types of household chores.

Food consumption pattern of the families indicated that rice was the staple food and all of them were non-vegetarians. Majority of the families planned their meal in advance and most of the families followed a three major meal pattern. Rice was used as the main dish by most of the families during breakfast, lunch and

dinner. Occasional purchase of prepared food items from hotels and bakeries was observed in majority of the families.

All the families celebrated special occasions like birthdays, marriages etc. and prepared various items depending on the religion, type and income. All the families prepared special foods during pregnancy, lactation, infancy etc. and most of the families modified their diet during illness.

Majority of the adolescent girls were non-vegetarians and never skipped their breakfast, lunch or dinner. Majority of the adolescent girls watched television daily for not more than 30 minutes and during holidays for more than 30 minutes.

Occasional eating of foods from outside was observed among majority of the girls and most of them insisted their parents to buy particular foods like chocolate, biscuits, ice-creams etc.

Anthropometric measurements revealed that mean body weight and height of adolescent girls were significantly low compared to the Indian standard given by ICMR (1990) except for the mean height of girls of 13 years which was comparable with standard values.

The weight for age distribution of girls according to Gomez *et al.* (1956) classification revealed that majority of the adolescent girls had grade I and grade II malnutrition. With regard to height for age classification suggested by Waterlow (1972) majority of the girls had normal height for age. Body Mass Index of adolescent girls revealed high prevalence of chronic energy deficiency of grade III.

Clinical examination revealed that among the girls with clinical manifestations 60 per cent of them were having symptoms of anaemia and 26.67 per cent were having dental carries.

In the present study it was found that more than 50 per cent of adolescent girls had lower levels of haemoglobin. Only 46 per cent of girls had acceptable haemoglobin levels.

Consumption of cereals, green leady vegetables, other vegetables, roots and tubers, fruits, milk and milk products, fats and oils, meat, fish and egg and sugar and jaggery was lower than the recommended level. Pulses were consumed more than the RDA by adolescent girls. Regarding the nutrient intake only energy was found to meet the RDA.

The increase in the intake of calories was associated with maximum increase in weight for age and height for age.

In the present study there observed no relation between haemoglobin levels and intake of nutrients like iron and protein.

None of the adolescent girls had good or excellent endurance capacity. Nearly half of the adolescent girls were found to be anaemic and hence resulted in a poor endurance capacity.

Two way frequency analysis revealed that there was consistent increase in the endurance capacity of girls as their nutritional status (as assessed by weight for age and height for age) improved.

Endurance capacity with haemoglobin levels when analysed, a linear relationship was observed between these variables. Girls with acceptable haemoglobin levels showed high average endurance capacity.

More girls with high average endurance capacity (57 per cent) showed adequate energy intake. Even though all other nutrients contribute to endurance capacity no relationship was observed between these variables. The limitations of dietary assessment based on one day survey, should be kept in mind in interpreting the relationship between diet and nutritional status.

In the present study also the intake of all the nutrients except energy was found to be low in the daily diets of adolescent girls. It must also be pointed out that endurance capacity may also be influenced by other nutrient deficiencies like iron and B complex vitamins. Hence this study clearly indicates the need for improving the family diet of rural adolescent school girls.

More girls coming under normal group (weight for age) with adequate energy intake had high average endurance capacity. No relationship was observed between endurance capacity – height for age and energy intake.

A high average endurance capacity was observed among girls with more walking distance and participation in sports and game activities.

The delayed adolescent growth could be due to low current nutritional intakes to meet the increased requirements of the adolescents. Hence nutrition education and short term appropriately planned nutritional intervention can be beneficial for improving adolescent growth and also encouraging in the participation of sports and games will improve their endurance capacity.

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Appendices

APPENDIX-I

KERALA AGRICULTURAL UNIVERSITY

Department of Home Science

INTERVIEW SCHEDULE TO ELICIT INFORMATION REGARDING THE SOCIO-ECONOMIC CONDITIONS OF THE FAMILIES

1. Name of the head of the family :
2. Address :
3. Place of Survey :
4. Age of the respondent :
5. Type of family : Joint/Nuclear
6. Family size : No. of adults/children
7. Religion : Hindu

   1. Nair
   2. SC
   3. OBC

   Christian

   Muslim
8. Educational levels : Illeterate/LPS/UPS/High School/College

   Father :

   Mother :

   Guardian :
9. Occupational status

   Father : Yes/No

   If yes : Gazetted/Non Gazetted

   a) Gazetted
   1. Doctor
   2. Govt. College Professor
   3. Govt. School headmaster
   4. Engineer
   5. Agricultural Officer

6. Others, Specify
b) Non Gazetted
1. Lecturer
2. Teacher
3. Bank
4. Clerk
5. Engineer
6. Others, Specify

Mother : Yes/No
a) Gazetted
1. Doctor
2. Govt. College Professor
3. Govt. School headmistress
4. Engineer
5. Agricultural Officer
6. Others, Specify
b) Non Gazetted
1. Lecturer
2. Teacher
3. Bank
4. Clerk
5. Engineer
6. Business
7. Others, Specify

10. Working abroad : Father : Yes/No
Mother : Yes/No

11. Other sources of income of the family : 1. Agriculture
2. Poultry
3. Cattle wealth
4. House rent
5. Any other

12. Total income (Rs./month) approximately : 1. Agriculture : Rs.
2. Others : Rs.
3. Total : Rs.

13. Details of housing condition :

A) 1. Area in sq. feet :

2. Type of house : 1 room/2 room/3-4 room/6-8 room/8-& more

3. Type of roof : Tiles/Concrete/Thatched/Others/Specify

4. Type of wall : Mud/Stone/Brick/Others/Specify

5. Type of floor : Tiled/Concrete/Mosaic/Marble/Granite/ Cowdung/Mud

6. Separate room for individual members : Yes/No

B) Details of ownership

1. Staying in own house : Yes/No
   If yes, any housing loan : Yes/No

2. Staying in rented house : Yes/No

3. Rent received if a portion is left out : Rs. /month

C) Other characteristics

1. Separate kitchen : Yes/No
2. Separate rooms in the house : 1. Drawing room
   2. Study room
   3. Bed room
   4. Store room
3. Source of drinking water : Own well/Public tap/Public well/Tank/River
4. Lavatory facilities : Yes/No
   Own latrine/Public latrine
5. Drainage facilities : Yes/No
6. Electricity facilities : Yes/No
7. Information source utilisation of recreational facilities : Newspaper, magazines, own radio/Radio and T.V., T.V., V.C.R. etc.

14. Monthly expenditure pattern

Sl.No.	Item	Expenditure Monthly (Approximately)
1	Food	
2	Clothing	
3	Shelter	
4	Rent	
5	Transport	
6	Education	
7	Entertainment	
8	Savings	
9	Health	
10	Own expenses	
11	Repayment of loans	
12	Kuries	
13	Fuels	
14	Others	

15. Labour saving devices at home : Oven
Mixie
Washing Machine
Electric cooker
Vaccum cleaner
Any other specify

16. Tupe of fuel used : Wood/Kerosene/Cooking gas

Source :

Details regarding the adolescent girl

1. Age :
2. Birth weight of the index child :
3. Birth order of index child : First/Second/Third/Fourth/Fifth/Sixth
4. Age at menarche :
5. Morbidity pattern of the index child (Details of epidemic that had affected your child (Index child) during the past one year :

Disease	Duration	Treatment
1. Diarrhoea/Vomiting		
2. Measles		
3. Chicken pox		
4. Mumps		
5. Fever		
6. Jaundice		
7. Respiratory diseases		
8. Others specify		

6. When anybody in your family is sick, Do you make use of health centre facilities : Yes/No
1) Hospitals
a. Government (Local PHC/District Hospital)
b. Private
2) Dispensary
3) Maternal and child health centre
4) Ayurvedic
5) Homeo
6) Own medication
7) Others, specify

7. Involvement in household duties : Yes/No
If yes, How often : Daily, Holidays, Never

1) Washing clothes (D,H,N)
2) Washing utensils (D,H,N)
3) Sweeping (D,H,N)
4) Gardening (D,H,N)
5) Cooking (D,H,N)
6) Care of the younger siblings (D,H,N)

8. Provision for physical education in school : Yes/No
   a) If yes, duration : 1) ½ hour in a week
      2) 1 hour in a week
      3) 2 hour in a week
      4) More than 2 hours

   b) Participation in sports and game activities : Yes/No
      If yes, where do you play : School/Near the house hold/others/specify
      Name of the game :
      Duration :

   c) Participation in competitions : Yes/No
      If yes : School level
      District level
      State level
      National level

9. Involvement in other activities : NCC/Recreations/Entertainments/Others

10. Practising exercise/Yoga : Yes/No

11. Mode of travel to school : Walking/Cycling/Bus/Others

12. Distance of travel to school :

****

APPENDIX-II

KERALA AGRICULTURAL UNIVERSITY

Department of Home Science

INTERVIEW SCHEDULE TO ELICIT INFORMATION ON FOOD CONSUMPTION PATTERN OF THE FAMILY AND DIETARY HABITS OF THE ADOLESCENT GIRL

1. Serial No. :

2. Name of the house wife :

3. Address :

4. Place of Residence :

5. Age :

6. Food habit : Veg./Non Veg.

7. Who decides the menu of the day :
   1) Father
   2) Mother
   3) Children
   4) Grand father
   5) Grand mother
   6) Servant

8. Do you plan your meal in advance : Yes/No

9. Meal pattern of the family :
   1) One major meal
   2) Two major meals
   3) Three major meals

10. Food expenditure pattern :

Sl.No.	Food stuff	Amount spend per month
1	Cereals	
2	Pulses	
3	Other vegetables	
4	Green leafy vegetables	
5	Roots and tubers	
6	Meat	
7	Chicken	
8	Fish	
9	Egg	
10	Fruits	
11	Milk	

11. Common breakfast preparations : Coffee/Tea/Milk/Other Health drinks
(More than 3 times a week)

Major	Side Dish
1. Pittu	1. Dhal preparation
2. Iddli	2. Other vegetable preparation
3. Dosa	3. Roots and tubers preparation
4. Uppma	4. Green leafy vegetable preparation
5. Appam	5. Egg preparation
6. Poori	6. Meat preparation (Beef/Mutton/Other)
7. Chapathi	7. Chicken preparation
8. Paratha	8. Chutneys
9. Bread	9. Fruits
10. Idiappam	
11. Rice	
12. Any other	

12. Common preparations for lunch
(More than 3 times a week)

Major	Side Dish
1. Rice	1. Dhal preparation
2. Biriyani	2. Other vegetable preparation
3. Fried rice	3. Green leafy vegetable preparation
4. Pulav	4. Roots and tubers preparation
5. Chapathi	5. Meat preparation (Beef/Mutton/Other)
6. Paratha	6. Fish preparation
7. Any other	7. Chicken
	8. Egg preparation
	9. Fruits
	10. Curd
	11. Butter milk

13. Common preparations for Tea time :

a) Tea/Coffee/Milk/Health drink/Any other
b) 1. Awal
2. Vada
3. Cutlet
4. Samosa
5. Pakodas
6. Banana fry
7. Kesari
8. Ada
9. Cake
10. Sandwich
11. Fruits
12. Any other

14. Common preparations for dinner
(More than 3 times a week)

Major	Side Dish
1. Rice 2. Chapathi 3. Paratha 4. Nan 5. Battura 6. Any other	a) Dhal preparation b) Other vegetable preparation c) Green leafy vegetable preparation d) Roots and tubers preparation e) Fish preparation f) Meat (Beef/Mutton/Other) g) Chicken h) Egg preparation i) Curd j) Butter milk

15. Do any family member have the habit of drinking milk while going to bed : Yes/No
If yes : Who?

16. Consumption of raw foods : Yes/No (Salads, Raithas, Others)

17. Specific time schedule for eating food : Yes/No

18. Frequency of use of different food materials

Foods	Daily	Frequency of use weekly				Occas-ionally	Never
		Once	Twice	Thrice	Four times		
1. Cereals							
2. Pulses							
3. Green leafy vegetables							
4. Roots and tubers							
5. Other vegetables							
6. Fruits							
7. Milk and milk products							
8. Meat							
9. Fish							
10. Egg							
11. Fats and oils							
12. Sugar & jaggary							

19. Frequency of purchase of processed foods

Foods	Daily	Frequency (weekly)				Occas-ionally	Never
		Once	Twice	Thrice	Four times		
1. Idli mix 2. Dosa mix 3. Corn flakes 4. Sambar mix 5. Vermicelli 6. Noodles 7. Milk maid 8. Milk 9. Ice cream mix 10. Paneer 11. Gulab Jamun mix 12. Jam 13. Cheese/Butter 14. Jelly							
<u>Beverages</u> 1. Tea/Coffee 2. Squash 3. Cococola/Pepsi/ any other 4. Carbonated beverages <u>Bakery items</u> 1. Bread 2. Cakes 3. Pasteries 4. Sauces 5. Kitchen-ups 6. Pickles 7. Biscuits <u>Fried Foods</u> 1. Chips 2. Mixtures 3. Samosa/Puffs 4. Cutlet 5. Pappads 6. Vattals							

20. Do you prepare any processed foods : Yes /No.
(a) Jams
(b) Jellies
(c) Squashes

(d) Ketchups
(e) Pickles
(f) Carbonated beverages
(g) Any other, specify

21. Do you purchase any prepared food : Yes/No.
If Yes, what type of food purchased : Veg/Non Veg/Both
From where : Hotels/Bakery/Fast Food Centres

22. Frequency of purchase of prepared foods

Items	Daily	Weekly				Occasionally	Never
		1	2	3	4		

23. Reasons for purchase :

24. Do you prepare different foods on special occasions : Yes/No.

If Yes,

Occasion	Foods prepared	Reasons
Birthday Marriage Death Festivals Feasts Others		

25. Do you prepare different foods on special conditions : Yes/No

Conditions	Foods prepared	Reasons
Infancy Pre-school School going Pregnancy Lactation Old age Examination time		

26. Foods avoided/included during diseased conditions?

Disease	Foods included	Foods Avoided
Fever Diarrhoea Jaundice Chicken Pox Measles		

27. Do you prepare special foods for children : Yes/No
If yes, specify

28. Do your child like your preparation : Yes/No
If yes, what type of preparations :
If No, Reasons :

EATING-HABITS OF THE ADOLESCENT GIRL

1. Food habit : Veg./Non Veg.

2. Meal pattern : One major meal
Two major meals
Three major meals

3. Do you have the habit of taking breakfast. If No, reason : Yes/No

4. Do you have the habit of taking lunch. If No, reason : Yes/No

5. Do you take packed lunch : Yes/No
If yes, what type of food : Bread
Rice
Chappathi
Breakfast items
Any other

If no, from where do you take lunch :

6. Do you have the habit of taking snacks during tea time : Yes/No

   If No, reason :

7. Do you prefer home made or purchased snacks :

   Home made
   Purchased
   Both
   None

8. Do you have the habit of taking dinner : Yes/No
   If No, reason :

9. Do you like fried foods : Yes/No

10. Do you have the habit of taking snacks in between meals : Yes/No
    If yes, type of foods :

11. Do you have the habit of watching TV : Yes/No
    If Yes

Time spent on watching TV	1	2	3	4	5
Do you eat something while you Watch TV : Yes/No	15mt.	30mt.	1hr.	2hr.	>2hr.

    If yes
    The type of foods you eat : Chips
    Nuts
    Fruits
    Choclates
    Sweets
    Any other fried foods

12. Do you consume raw foods : Yes/No.
    If yes, type Salads
    Raithas
    Fruits
    Others, specify

13. Do you keep specific time schedule for have food : Yes/No

14. Do you take meals along with other family members : Yes/No

15. Do you have the habit of taking food from outside : Yes/No
    If yes : Veg./Non Veg.
    From where : Hotels/Fast food centres/ Bakery
    Frequency : Monthly/Weekly/daily

16. Type of food preferred for eating from outside

Items	Daily	Weekly				Occasionally	Never
		1	2	3	4		
1. Fruit juices							
2. Milk shakes							
3. Cutlets							
4. Samosa							
5. Puffs							
6. Chapathi							
7. Meals							
8. Paratha							
9. Biriyani							
10. Noodles							
11. Fried rice							
12. Chicken preparation							
13. Fish preparation							
14. Egg preparation							

17. Do you cook food at home : Yes/No
If yes, what type of foods : Uppma
Chapathi
Pittu
Dhal preparations
Thorans
Meat preparations
Fish preparations
Egg preparations
Rice
Noodles
Pulav
Biriyani
Ada
Kesari
Cutlet
Any other, specify

18. Do you suggest your parents to buy some particular foods : Yes/No
If yes, what type of foods : Choclates
Ice Creams
Biscuits
Chapathi
Paratha
Battura
Nan
Pizza

6. Do you have the habit of taking snacks during tea time : Yes/No

   If No, reason :

7. Do you prefer home made or purchased snacks :

   Home made
   Purchased
   Both
   None

8. Do you have the habit of taking dinner : Yes/No
   If No, reason :

9. Do you like fried foods : Yes/No

10. Do you have the habit of taking snacks in between meals : Yes/No
    If yes, type of foods :

11. Do you have the habit of watching TV : Yes/No
    If Yes

Time spent on watching TV	1	2	3	4	5
Do you eat something while you	15mt.	30mt.	1hr.	2hr.	>2hr.

    Watch TV : Yes/No
    If yes
    The type of foods you eat : Chips
    Nuts
    Fruits
    Choclates
    Sweets
    Any other fried foods

12. Do you consume raw foods : Yes/No
    If yes, type Salads
    Raithas
    Fruits
    Others, specify

13. Do you keep specific time schedule for have food : Yes/No

14. Do you take meals along with other family members : Yes/No

15. Do you have the habit of taking food from outside : Yes/No
    If yes : Veg./Non Veg.
    From where : Hotels/Fast food centres/ Bakery
    Frequency : Monthly/Weekly/daily

Cutlet
Sandwich
Samosa
Puffs
Biriyani
Noodles
Fried rice
Meat preparation
Fish preparation
Egg
Fruits

19. From where did you get information about this food :

1. Books/Magazines/News paper
2. Friends
3. T.V. ads
4. Relatives
5. Shops
6. Others

20. a) Are you weight conscious : Yes/No
b) If yes, for keeping your weight what do you do :

1. Diet control
2. Skip a meal
3. Exercise
4. Walking
5. Cycling
6. Any other
7. None

c) Time spend on this daily : < 15 mts
15 mt
30 mt
1 hour
1½ hours
2 hour
> 2 hour

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APPENDIX-III

KERALA AGRICULTURAL UNIVERSITY

Department of Home Science

SCHEDULE FOR CLINICAL EXAMINATION

State:	District:	Taluk:	Block:
F. No.:	Sl. No.:	Village:	Date:
Name of the subject:		Sex: M/F	Date of Birth:
Name of the father/guardian:		Occupation:	

Age: Yrs Mths

Physiological status: BF/BF+S/Not BF/Preg./Lact/NPNL/Not Applicable

Duration in months

ANTHROPOMETRY:

Height (cm):	Arm Circumferance (cm):
Weight (kg):	Fat fold at triceps (mm):

CLINICAL EXAMINATION

	:	Sparse	01:
Hair	:	Discoloured	02:
	:	Easily Plucked	03:
		Moon face	04:
		Oedema	05:
		Emaciation	06:
		Marasmus	07:
		Conj. Xerosis	08:
		Bitot's spot	09:
		Night blindness	10:
		Angular stomatitis	11:
		Cheilosis	12
		Nasolabial Dyssebacea	13:
	:	Red & Raw	14:
Tongue	:	Papillae Atrophic	15:
	:	Papillae Hypertrophic	16:
		Pellagra	17:

		Phrynoderma	18:
		Koilonychia	19:
		Epiphyseal Enlargement	20:
		Beading of Ribs	21:
		Knockness/Bow legs	22:
		Frontal parietal bossing	23:
	:	Caries	24:
Teeth	:	Mottled Enamel	25:
	:	Goitre	26:
		Tuberculosis	27:
		Filariasis	28:
		Leprosy	29:
		Others (specify)	30:

APPENDIX-IV(a)

FAMILY AND INDIVIDUAL FOOD CONSUMPTION SURVEY - WEIGHMENT METHOD

Name of the Investigator :

Name of the head of the family :

Name of the subject :

Serial No. :

Address :

Date :

Food consumption

Name of the meal	Method	Weight of total raw ingredients used by the family (g)	Weight of total cooked food consumed by the family (g)	Amount of cooked food consumed by the individual (g)	Raw equivalents used by the individuals

APPENDIX-IV(b)

FAMILY AND INDIVIDUAL FOOD CONSUMPTION SURVEY - WEIGHMENT METHOD

Family No. Name of the head of the family: Date:

District : State. :

Age and sex composition of those who have taken part in the meal

Age	Adult	12-21	9-12	7-9	5-7	3-5	1-3	Below 1	Guest (age)
Male Female									

Cereals

1. Rice
2. Rice flour
3. Wheat flour
4. Ragi
5. Maida
6. Semolina (Ravai)
7. Others

Pulses

7. Bengal gram
8. Black gram
9. Red gram
10. Soyabean
11. Green gram
12. Others

Leafy vegetables

13. Amaranth
14. Cabbage
15. Drumstick leaves
16. Others

Other vegetables
Roots and tubers

17. Carrot
18. Onion
19. Beetroot
20. Tapioca
21. Potato
22. Sweet potato
23. Yam
24. Others

Nuts and oil seeds

25. Cashewnuts
26. Coconut, dry
27. Coconut, fresh
28. Groundnut
29. Others

Spices and condiments

Fruits

30. Amla
31. Apple
32. Banana, ripe
33. Lime and orange
34. Mango, ripe
36. Watermelon
37. Grapes
38. Pineapple
39. Tomato, ripe
40. Others

Fish

41. Fish, fresh
42. Fish, dry

Other flesh foods

43. Meat
44. Chicken
45. Liver
46. Egg

Milk and milk products

47. Milk
48. Curds
49. Butter milk
50. Skimmed milk
51. Cheese

Fats and oils

52. Butter
53. Ghee
54. Hydrogenated oil
55. Cooking oil

Other food stuffs

56. Biscuit
57. Bread
58. Sugar
59. Jaggery
60. Pappad
61. Pickle

APPENDIX-V

ESTIMATION OF HAEMOGLOBIN
(Cyanmethaemoglobin method (NIN, 1983)

PRINCIPLE

The Hb (oxyhaemoglobin, methemoglobin, carboxy haemoglobin) is converted to cyanmethemoglobin according to the following reaction.

$$Hb \xrightarrow{K_3Fe(CN)_6} Methemoglobin$$

$$Methemoglobin \longrightarrow Cyanmethemoglobin$$

The absorbance of cyanmethmoglobin is proportional to the Hb concentration.

REAGENT

Drabkin's solution: Dissolve 0.05 g of KCN, 0.20 g of potassium ferricyanide and 1.00 g of sodium bicarbonate is 1 l of distilled water.

PROCEDURE

20 µl of blood is transferred with the help of a Hb pipette into a test tube containing 5 ml of Drabkin's solution. Mixed thoroughly and reading taken in a photo electric colorimeter at 546 nm. Optical density of standard haemoglobin solution was also measured using a colorimeter. Hb content of the sample was found out by the formula

$$Hb\ (gm/dl) = \frac{\text{Optical density of sample}}{\text{Optical density of standard}} \times N \times 0.251$$

Where,

N = Concentration of standard haemoglobin = 60 mg/dl

NUTRITIONAL PROFILE AND ENDURANCE CAPACITY OF ADOLESCENT GIRLS

By

SEEJA THOMACHAN PANJIKKARAN

ABSTRACT OF THE THESIS

Submitted in partial fulfilment of the requirement for the degree of

Master of Science in Home Science

(FOOD SCIENCE & NUTRITION)

Faculty of Agriculture

Kerala Agricultural University

Department of Home Scicnce

COLLEGE OF HORTICULTURE

VELLANIKKARA, THRISSUR - 680 656

KERALA, INDIA

2001

ABSTRACT

The present study 'Nutritional profile and endurance capacity of adolescent girls' was conducted among 150 adolescent girls of 13-15 years of age. Information regarding the socio-economic conditions of the families indicated that majority of the families were Hindus. Nuclear families with satisfactory housing conditions and living facilities were the striking features observed. Majority of the family heads were labourers and earned Rs.1000 to 4000 per month.

Food consumption survey revealed that rice was the staple food and all of them were habitual non-vegetarians.

The prevalence of current malnutrition of various grades was found to be more among adolescent girls indicated by their weight for age.

The most common nutritional deficiency disease observed among adolescent girls was anaemia. More than 50 per cent of adolescent girls had lowe levels of haemoglobin.

Consumption of cereals, green leafy vegetables, othe vegetables, roots and tubers, fruits, milk and milk products, fats and oils, meat, and egg and sugar and jaggery were lower than the RDA. In case of nutrient only energy level was found to be adequate.

None of the adolescent girls had good or excellent e acity.

Body weight is an important factor contributin work capacity and high average endurance capacity was observe of girls with normal weight for age. Other contributing fact endurance capacity was their low haemoglobin levels and l spite of their low nutritional status and nutrient intake, activities have a positive effect on their endurance capacity